Scotts Creek Watershed Assessment

A Document of the Scotts Creek Watershed Council

Prepared for:

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TABLE OF CONTENTS

APPENDICES

TABLES

FIGURES

PLATES

Scotts Creek Watershed Assessment

1.0 Background

1.1 Watershed Assessment Purpose and Overview

The purpose of the Scotts Creek Watershed Assessment is to collect and integrate information on past and present watershed conditions and management. The assessment is intended as a tool to educate landowners and other watershed users on watershed conditions and management needs, and on how watershed conditions affect Clear Lake. This assessment is a collection of the watershed information that is currently available, and it helps to identify data gaps and future needs for information to understand watershed conditions and processes. It also provides a basis for watershed planning and identification of necessary watershed restoration and management projects.

Following this introductory section, this document begins with sections describing watershed history, resources and processes and land use (Sections 2-16). The agencies and organizations involved in watershed management are covered in Section 17. Section 18 summarizes findings related to the watershed issues identified by the SCWC and identifies information gaps found during the assessment process.

1.2 History of the Scotts Creek Watershed Council

The Scotts Creek Watershed Council (SCWC, originally the Scotts Creek CRMP) was formed under the State of California's Coordinated Resource Management and Planning (CRMP) guidelines. The group of landowners and stakeholders came together to address their many issues of concerns in the watershed. The group began meeting informally in early 2000. With the assistance of the with West Lake Resource Conservation District's Watershed Coordinator the participants identified, listed and prioritized their issues and adopting a Memorandum of Understanding on May 5, 2000.

The overall goal of the SCWC is, "the protection and restoration of the watershed ecosystem" with four main components and numerous sub-components listed below:

- Ecosystem Improvement
    - Identify desired future watershed conditions.
    - Sustain adequate ground cover.

- Prevent discharge of pollutants.
- Reduce risk of erosion and sedimentation.
- Reduce risk of flood damage.
- Sustain/increase native fresh water fish species.
- Create and sustain diverse riparian habitat and wildlife diversity.
- Develop a database of biological resources.

❖ Fuel Management

- Manage woodland resources, remove dying trees, create strategic fuel breaks, and implement defensible space standards.
- Encourage citizens to manage fuel on private property.
- Manage fuel loads through prescription burning to reduce the risk of catastrophic wildfires.

❖ Enhance the viability of human uses in harmony with each other and all animal species that unitize the watershed

- Manage recreational use of the watershed to protect private property and natural resources.
- Create a partnership with the agricultural community to support the economic viability of agricultural areas in the watershed.
- Protect the rights and cultural heritage of the landowners in the watershed.

❖ Education

- Promote education with the latest available information on the function and management of the watershed.
- Develop demonstration sites, hold landowner/stakeholder workshops, and promote public education and awareness.

Figure 1-1 SCWC members collect native grass seed in Eight Mile Valley. *Photo by Greg Dills.*

The Council's planning process is done through consensus, concentrating on specific priorities as funding allows. Private landowners take lead roles in coordination and implementation of projects on private lands, and public land managers and conservation groups take the lead on public lands.

The numerous projects accomplished by the council and its cooperators include:

- Holding annual creek cleanups removing hundreds of cubic yards of illegally dumped debris.
- Supporting construction of a five-mile firebreak cooperation with the Bureau of Land Management (BLM) and the West Lake Resource Conservation District (RCD) and private landowners.
- Organizing many educational workshops and watershed tours for landowners.
- Propagating native plants .
- Identifying and removing over 7,000 yd^3 of debris in the lower watershed following 2005 flooding.
- Initiating non-native invasive weed eradication including the first *Arundo donax* eradication project in Lake County.
- Participating in hosting the annual "Kids in the Creek" event.
- Organizing the first annual "Year in Review" West Lake RCD presentation.
- Participating in Citizen Water Quality Monitoring Program.
- Assisting in obtaining "Rights of Entry" from landowners in the Scotts Creek Watershed for several cleanup and vegetation management projects.
- Participating in staffing a watershed information booth at the Lake County Fair and community events.
- Providing letters of support for numerous grant funded projects.

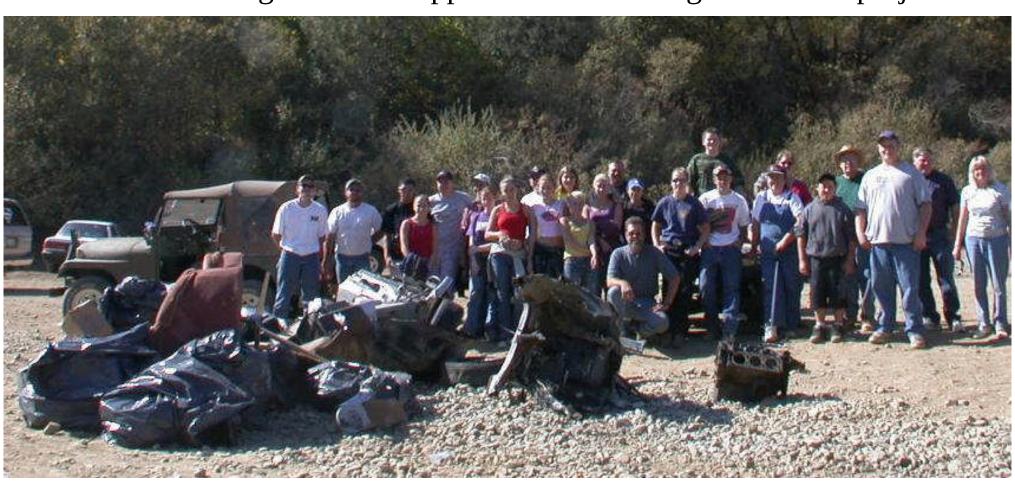

Figure 1-2 Creek clean up in 2002. *Photo by Greg Dills*

1.3 1997 Scotts Creek Watershed Project

The Lake County Flood Control and Water Conservation District received 319H funding in 1995 for the Scotts Creek Watershed Project to enhance public understanding of the causes and solutions to erosion and their linkage to Clear Lake water quality. This project included a variety of approaches including computer modeling and data analysis, demonstration projects, water quality monitoring, and numerous public workshops. Completed tasks included:

- GIS analysis of erosion potential in the watershed.
- Trail analysis of the BLM South Cow Mountain off-highway vehicle (OHV) recreation area.
- Three stream channel restoration projects on the gravel mined section of Scotts Creek.
- Two levee setback and re-vegetation projects.
- A native plant nursery.
- Scotts Creek water quality monitoring.
- Summary of Clear Lake water quality data.

These projects and analyses are summarized in the final report on the Scotts Creek Watershed Project, which is available at the Water Resources Division (WRD) of the Lake County Department of Public Works (LCFCWCD 1997).

1.4 Current Watershed Assessment Process

In December 2006, the West Lake RCD received proposition 50 funding for watershed planning and capacity building. As part of the grant, the SCWC is following the California Watershed Assessment Manual approach for watershed assessments in preparing this watershed assessment. In 2007 the SCWC held stakeholder meetings to identify the leading issues of concern in the watershed. While the scope of the assessment goes beyond these issues, this process helped to ensure that priorities of watershed stakeholders were addressed. The issues identified were:

- Protecting water quality.
- Ensuring water availability.
- Reducing wildfire threat.
- Flood management and debris jams.
- Reducing illegal dumping.
- Protecting open space.
- Improving wildlife habitat.

2.0 Watershed Description

The Scotts Creek Watershed is located in the Northern California Coast Ranges about 80 miles north of San Francisco (Plate 1). The watershed is almost entirely within the boundaries of Lake County, with only 0.1% located in Mendocino County, and it occupies an area of 105.5 square miles (67,525 acres). Elevations in the watershed range from 1,340 feet at the mouth of Scotts Creek where it enters Middle Creek to 3,924 feet at the top of Cow Mountain. The lowest portion of the watershed is comprised of fairly level valleys, Scotts Valley, Bachelor Valley and Tule Lake (Plate 4). Blue Lakes, two lakes in the northwest portion of the watershed, occupy a narrow canyon at approximately 1,400 feet elevation. The western portion of the Scotts Creek Watershed lies in the Mayacmas Mountain Range, a mountain chain dividing the headwaters of the Russian River from Clear Lake. The majority of the upper watershed is comprised of steep, rugged terrain. In addition there are two small, relatively level valleys, Benmore Valley and Eight Mile Valley.

Scotts Creek is the largest tributary to Clear Lake, which is the largest natural freshwater lake located entirely in California. The Scotts Creek Watershed comprises 23% of the Clear Lake Basin and contributes an estimated 24% of streamflow to Clear Lake. Clear Lake has apparently existed as a shallow lake for at least 480,000 years because the lake basin has shifted downward at approximately the same rate that sediment fills it in (Richerson et al. 1994). Clear Lake is not especially clear as its name implies, but has been a eutrophic, or algae and plant rich lake, throughout its history (Sims et al. 1988). This abundant growth in turn feeds large fish and wildlife populations. Clear Lake drains to the east via Cache Creek into the Sacramento River.

California Highway 20 runs east-west across the northern portion of the watershed, and Highway 175 crosses the southern tip of the watershed (Plate 2). There are no towns in the Scotts Creek Watershed, although the City of Lakeport (approximate population 5,200) is located just outside the watershed boundary to the east. The most heavily populated areas of the watershed include Scotts and Bachelor Valleys, and the area along the Blue Lakes/Highway 20 corridor (Plate 3). The broad expanse of Scotts Valley, with elevations ranging from 1,460 feet in the south to 1,400 feet in the north has long been an important agricultural center in Lake County. Bachelor Valley, Tule Lake and Benmore Valley are smaller agricultural areas (Plate 4).

3.0 Watershed History

At the time of European contact, Native Americans had been living in the vicinity of Clear Lake for at least 10,000 years, and they lived in balance with the environment. The arrival of Europeans was devastating for native peoples who were decimated by new diseases, forcibly relocated and forced to work for Europeans, and severely punished or killed for lack of cooperation. The history of interactions among Native Americans, the Spanish, Mexicans, U.S. citizens, and other European settlers is long and complex and is beyond the scope of this assessment. This section will focus on ways in which people made use of watershed resources and the changes that occurred due to human activities.

At the time of European contact most Native American people in the Scotts Creek Watershed belonged to groups speaking the Northern and Eastern Pomo languages. People speaking the Northern Pomo language lived from the Mendocino Coast to the western side of Clear Lake. The area of Eastern Pomo speakers began in the vicinity of Clear Lake (McLendon and Oswalt 1978). Within the areas where these major languages were spoken, were numerous village-communities or tribes that occupied defined territories recognized by themselves and surrounding communities. In the area of Scotts Valley, Blue Lakes, Tule Lake, and extending to Clear Lake, lived the Yima, a group comprised of both Northern and Eastern Pomo (McLendon and Oswalt 1978, Patrick 2008).

These native people lived on the abundant natural resources available in the area. Harvested plants included acorns, buckeye nuts, grass seeds, roots and bulbs, berries, and edible greens. Game animals including deer, elk, rabbits, and squirrels (Bean and Theodoratus 1978). Fish were caught from Clear Lake and its tributaries. Near Clear Lake, fishing activities were concentrated on the spring spawning season when vast numbers of fish filled the creeks surrounding the lake, and fish were dried and stored to be eaten for the rest of the year (McLendon and Lowy 1978). Northern Pomo speakers frequently built their houses of timber, while Eastern Pomo, in the vicinity of Clear Lake, used tules to build houses and boats and for clothing including skirts, mantles, moccasins, and leggings.

While these native people made extensive use of natural resources without apparently over-using resources, one way they may have actively modified their environment was through the use of fire. Although one study of the Clear Lake area found that “Indian burning in the Clear Lake area was on such a limited scale that it had little effect on the vegetation cover” (Simoons, F.J. 1952), a compilation of references on the use of fire by Native Americans lists references for Pomo tribes in general and for Northern Pomo (Williams, G.W. 2003). The compilation gave a variety of reasons for which Native Americans used fire. These include clearing ground for acorn harvest, travel, or hunting, and increasing food availability for prey animals. Accidental fire starts also occurred.

There are several histories (Deacon 1948, Ussery 1978) that chronicle the settlement and lives of early European and American Settlers to the Scotts Valley area. At the time of European contact, the upper portions of the Scotts

Creek Watershed may have looked much as they do today. Simoons (1952) collected historic descriptions of vegetation in Lake County. An 1851 expedition by Colonel Redick McKee, United States Indian Agent, described vegetation of the Mayacmas Range near the Scotts Creek Watershed to the South of Big Valley , "the crest of the mountains being covered only with chamisal, dwarf-oak and mansanita bushes" (Gibbs 1851 quoted Simoons 1952).

In the large, low elevation valleys, however, most of the native vegetation has long ago been cleared to make room for agriculture. Simoon quotes Henry McCullough, aged 79 at the time of the 1951 interview, on the vegetation present in Scotts Valley prior to settlement. "Scotts Valley floor was covered with oak trees of good size, interspersed with thick brush. Included in the vegetation cover were dogwood, wild grapes, and wild blackberries". A similar picture is given in Deacon's history of Scotts Valley (Deacon 1948):

> The land was thickly covered with a dense growth of all kinds of tall brush, thickly matted with wild grape and blackberry vines. Many large oaks, some six feet in diameter, and ash, alder, willow, and pepperwood trees were growing thickly here also. Some of the grape vines were eight or ten inches in diameter and had grown to a height of a hundred feet into the treetops.

Changes in watershed conditions began soon after the arrival of Europeans. Starting in the 1830s hunters and trappers came to Lake County. In 1839 Salvador Vallejo and his brother Juan Antonio began grazing cattle throughout a large land grant covering the areas of Upper Lake, Bachelor Valley, Scotts Valley, and Big Valley. Settlement by American agriculturists began soon after California gained statehood in 1850, and there were about 1,000 Americans in the area of Lake County by the time of the 1860 census. Farmers made up the majority of the population, and they cleared land, primarily in the valleys, to plant crops such as grains, potatoes, grapes, and orchard crops. Lake County's geographic isolation precluded large scale commercial production of these crops because transportation to market was too difficult. Cattle and sheep production became the major source of income during the twenty years after agricultural settlement because the animals could be driven over the mountains to markets (Simoons, F.J. 1952).

Livestock grazing had a dramatic effect on the grasses found in grasslands and oak woodlands.

> "The interior grassland was probably dominated by half a dozen species of bunchgrasses, particularly purple and nodding needlegrasses (sp. *Nasella*), fescue (*Festuca californica*), ryegrass (*Elymus glaucus*), squirrel tail (*Sitanion hystrix*) and two species of melic grass (sp. *Melica*)…The grazing pressure

> and soil-surface disturbance favored exotic annuals over the native bunchgrasses. In addition, fire was controlled and weed seeds were accidentally introduced. In a dramatically short time, bunchgrass prairie was converted to an annual grassland of European grasses and forbs" (Barbour, M.G. and Whitworth, V. 2001).

The use of fire by settlers was probably common prior to the early 1900s. Cattlemen and sheep herders burned brush lands to increase forage for livestock, and hunters and campers frequently set fires (Simoons, F.J. 1952).

Mineral spring resorts in Lake County became popular vacation spots for visitors from the Central Valley and San Francisco Bay Area starting in the 1850s. On the west side of Bachelor Valley cold mineral springs were discovered in 1870, and soon after the Witter Springs medicinal resort opened. The resort was expanded with the opening of the expansive Witter Hotel in 1906, but soon after the San Francisco earthquake of 1906 caused a decline in guests and forced the owners into bankruptcy. In 1916 the hotel was dismantled and salvaged. Witter water continued to be bottled and sold by various companies into the 1950s (Hoberg 2007). Other cold mineral springs were discovered at Saratoga Springs, east of Blue Lakes on Highway 20. The springs opened originally as Pearson's Springs Hotel by 1879. Today the Saratoga Springs Resort is operated as a retreat and conference center and still includes one of the old hotel buildings and a pool fed by the springs.

Blue Lakes became a popular destination for visitors in the 1870s. The first hotel to open was the Blue Lakes Hotel, which opened in 1870 on the west end of upper Blue Lake at the current location of the Pine Acres Resort. Hotel buildings there were destroyed by fire several times during the history of the resort. Le Trianon Resort on the opposite end of upper Blue Lake was built in 1875, and it also continues as a summer resort to the present day. On lower Blue Lake, or Laurel Dell Lake, the Laurel Dell cottages and hotel were built between 1878 and 1900, and they closed following a fire in 1942 (Hoberg 2007).

Commercial agriculture began to expand in Lake County in the early 1900s as transportation routes were improved. Henry Wambold, who built the Laurel Dell Hotel, built a cannery for string beans nearby in 1891. To expand bean growing he "reclaimed the land known as Tule Lake, by draining the land, turning the soil, raking the tule roots from the soil and hauling them away" (Parola 1970). Later canneries were opened in Lakeport and Upper Lake, and one remained in production in Upper Lake as late as 1967 (Lake County Coordinating Council 1967).

The areas of walnuts and pears in Lake County both began to increase starting in the 1920s. With only one period of decrease in the 1940s, crop area countywide increased to almost 10,000 acres of walnuts and 8,000 acres of pears by 1980. Much of the walnut acreage was unirrigated orchards on hillsides, while some of the acreage was on level ground and irrigated. Pear orchards were found on level valley ground. Initially, many were unirrigated,; however, there was a transition to irrigation because it led to substantially higher yields. Important crops reported in Scotts Valley in 1944 and 1950 included pears, walnuts and hops, and green beans, grown primarily in the Tule Lake reclamation area. In 1944 there were approximately 800 dairy cows in the combined Scotts Valley and Upper Lake areas (USDA SCS 1953, USDA SCS 1944). Since 1980, there has been a continuous decline in the acreage of pears and walnuts in Lake County to about 2,500, and 2,800 acres respectively by 2005. Beginning in the 1980s, winegrape acreage has increased from 3,000 to 8,500 acres in Lake County, however very little of this, 183 acres[1], is located in the Scotts Creek Watershed.

While many land use activities have the potential to increase soil erosion, it appears that use of heavy earth-moving equipment made the greatest difference in erosion from the watershed. Researchers found a 10-fold increase in sedimentation rate to the lake from the time period before to the time period after 1927 (Richerson et al. 2008). They attributed this increase to newly available heavy earth-moving equipment, which led to activities such as increased road building, reclamation of approximately 2,000 acres of wetland in the Rodman Slough area, open pit mining adjacent to Clear Lake, and increased in-stream gravel mining. Gravel for use inside Lake County for construction and road building was taken primarily from stream systems prior to about 1985 (LCPD 1992). Gravel mining and many other activities directly altering stream channels are described in Section 7.4 and 7.6.

4.0 Geology

The California Coast Ranges were created when ocean and continental plates collided and “sediments, submarine volcanoes, and oceanic crust were scraped from the down-going plate and attached to the North American plate” (Moores and Moores 2001). This process of subduction created the Franciscan Complex, the mixture of rocks comprising much of the California Coast Ranges. Movement of tectonic plates on the California coast later produced a series of faults paralleling the San Andreas fault. These faults create the north/northwest-south/southeast valleys and ranges seen in the Coast Ranges (Christensen Associates Inc. 2006).

The Scotts Creek Watershed is underlain by the Franciscan Complex, or Franciscan Mélange, described in Roadside Geology as “one of the world’s great messes. It is a wild assortment of sedimentary rocks, deposited in seawater at many depths and in widely separated parts of the ocean, along

[1] Based on California Department of Water Resources 2002 land use data.

with generous slices of the basalt ocean floor" (Alt and Hyndman 2000). The most common type of rock in the Franciscan Complex and in the Scotts Creek Watershed is sandstone, or greywacke, a sedimentary rock (Plate 5). Mudstone, a variation of this sedimentary rock made from finer, clay and silt-sized particles, is found on the northern border of the watershed. Other rocks were formed by alterations of the ocean crust. Greenstone, found in several areas of the Scotts Creek Watershed, is metamorphosed volcanic rock (basalt) from ocean plates. Serpentinite is rock formed by one or more serpentine minerals, which are minerals formed by hydration of oceanic rocks.

The Clear Lake basin was created by the interaction of faults in the San Andreas system. The area underlying the main portion of the Clear Lake basin began to subside about 600,000 years ago in association with the eruption of a portion of the Clear Lake volcanic field (Hearn, B.C. and R.J. McLaughlin 1988). The lake has remained shallow with the rate of downward vertical movement of the basin roughly equal to the rate of sedimentation (Richerson et al. 1994).

The 1970 Scotts Valley groundwater study offers a description of recent geologic changes that formed the valley and its aquifers (Wahler & Associates 1970). Geologists estimate that approximately 10 to 20 thousand years ago the level of Clear Lake was almost 300 feet higher than it is today, and Scotts Creek flowed into the lake from the west near the present site of Lakeport. The terrace deposits of the Lakeport ridge, which today separate Scotts Valley from Lakeport, are part of the large delta formed by Scotts Creek as it flowed into Clear Lake. At this time the outlet to Clear Lake was to the west, through the canyon where Blue Lakes are now located.

The level of Clear Lake dropped to near its present level, and the lake's outlet shifted to the east when Cache Creek eroded upstream and reached Clear Lake. The lake level dropped nearly 300 feet as Cache Creek eroded through sediments until it reached hard rock at the Grigsby Riffle. At the same time, Scotts Creek stopped flowing into the lake from the west instead braking into the old outlet of Clear Lake to the west. This caused Scotts Creek to erode out its old delta, carving out Scotts Valley and leaving the Lakeport Ridge. Gravelly deposits at this new base level of Scotts Creek form the principal aquifers in Scotts Valley today.

A landslide to the west of Blue Lakes blocked off the outlet to Scotts Creek, creating a lake in Scotts Valley. Nearly 100 feet of bluish clays were deposited in the lake, covering the Scotts Valley aquifer. At the upper end of the valley, a gravelly and sandy delta from the creek is in contact with the confined portion of the aquifer. Eventually, Scotts Creek joined the Upper Lake drainage to Clear Lake, draining Scotts Valley Lake, and leaving the valley as we know it.

5.0 Soils

The major factors influencing soils in the Scotts Creek Watershed include the topography of the area where the soils formed and the type of rock or unconsolidated material on which they formed. As a general rule, soils are shallower as slopes become steeper due to naturally higher rates of erosion. They are deepest in valley locations where eroded materials accumulate.

About 90% of the soils in the Scotts Creek Watershed are formed on sedimentary and metamorphic rocks from the Franciscan Complex (Plate 6). Alluvial soils occur in broad level valleys and are important agricultural soils. Much more limited areas of soils formed on ultramafic or volcanic rocks are also found in the watershed.

Alluvial soils occur primarily in the nearly level portions of the Scotts Creek Watershed including Scotts Valley, Bachelor Valley, Tule Lake, and Benmore Valley. Alluvial material, or alluvium, is sediment and gravel deposited by streams and rivers. Alluvial soils are generally deep and frequently have layers with different fine particle sizes (sand, silt, and clay) and varying gravel content. These layers affect the ability of water to drain through the soils. Alluvial soils often make excellent agricultural soils for field crops and perennial crops such as pears, walnuts, and grapes. Most of the valley floors of Scotts Valley and Bachelor Valley are covered by Class I agricultural soils, which is the highest classification for agricultural uses. In Scotts Valley major Class I alluvial soils include Lupoyoma silt loam and Maywood variant sandy loam. Still loam and Lupoyoma silt loam are the major Class I alluvial soils in Bachelor Valley.

Class I and II agricultural soils make up 6% of the area of the Scotts Creek Watershed. Additional agricultural soils include Tulelake silty clay loam, in the Tule Lake area, hillside soils that may be suitable for vineyards, and very gravelly soils along creeks which make up an additional 4% of the watershed area.

In most of the upland areas of the Scotts Creek Watershed, soils formed on sedimentary rocks such as sandstone and shale or metamorphic rocks such as schist. Due to naturally high rates of erosion on sloping ground, upland soils are frequently shallow, which means that they store relatively little water for plant growth.

Soils formed on ultramafic rocks in the Scotts Creek Watershed are found in a small area in the hills north of Bachelor Valley and in the center of the eastern edge of the watershed. Ultramafic rocks are often referred to incorrectly as serpentine. Because serpentine is a specific mineral found in a specific ultramafic rock, the more general term ultramafic is used here. Ultramafic rocks are infertile and sometimes contain elements that are toxic to most plants. They are high in magnesium and iron, and may be high in heavy metals such as nickel, chromium, and cobalt. They have low silicon content and generally have low calcium, potassium, and phosphorus. Only specially adapted plants can survive on some soils formed in ultramafic rocks, and vegetation is generally sparse on these soils.

6.0 Hydrology

6.1 Physical Conditions

Scotts Creek makes an S shape, occupying three parallel northwest-southeast oriented basins (Plate 2). The headwaters of Scotts Creek are to the south of Cow Mountain. The creek continues southeast over about 1/3 of the watershed before the junction with the South Fork of Scotts Creek. At this point the creek enters the broad and level portion of Scotts Valley and changes direction to flow northwest. The S shape is completed when Scotts Creek makes a gradual arc to the east in the area of Blue Lakes. The South Fork of Scotts Creek joins the main stream about two miles before Scotts Creek enters Scotts Valley. Along with Benmore Creek, the South Fork of Scotts Creek drains the southern portion of the watershed. Cooper Creek is the main creek draining Bachelor Valley and the northern portion of the watershed.

6.2 Diversions and Barriers

The best source of information on surface water diversions in the Scotts Creek Watershed are those that are legally permitted or registered with the state Water Resources Control Board Division of Water Rights[2]. As of September 12, 2008 there were 51 water rights permitted or registered in the watershed. Twenty-nine of these were appropriations, for which reporting of amounts of water use is required (Table 6-1). The remaining 22 registered water rights are presumably riparian rights, and amounts of water diversion were reported for only two, for a total of 6.4 acre-feet per year. It is likely that other, unregistered riparian uses also occur in the watershed. An unknown amount of water diversion occurs in the upper watershed for illegal marijuana cultivation (Section 15.2).

[2] The SWRCB Division of Water Rights keeps records of all legally recorded riparian rights and water appropriations in the state. Riparian rights apply to lands immediately adjacent to a water course and entitle the landowner to use a small amount of water for domestic or agricultural use. Riparian rights do not permit storage for use during the dry season or to use on land away from the water course or in another watershed. Appropriative water rights apply to water use on non-riparian land, or to use of more water than allowed under riparian rights. The Division of Water Rights requires registration of, but not a permit for, riparian rights, and reporting the amount of riparian water use is not required on the registration. To receive appropriative water rights, the water user is required to apply for a permit and to report the amount of the water appropriation.

Table 6-1 Locations of appropriative water rights in the Scotts Creek Watershed.

Location of water diversion	Amount (acre-feet/year)
Scotts Creek	141.6
Dayle Creek	35
Pool Creek	24.4
Various Springs	1.6
Unspecified location	618.2
Total appropriative rights	820.8

Source: California State Water Resources Control Board Division of Water Rights eWRIMS mapping application <http://waterrightsmaps.waterboards.ca.gov/ewrims/gisapp.aspx> (Accessed 09.12.08)

Barriers to fish passage were recorded in California Department of Fish and Game (DFG) stream surveys, which have been carried out on Scotts Creek and some of its tributaries. Surveys found no naturally occurring barriers large enough to prevent fish passage on Scotts Creek from the headwaters to the mouth (DFG 1959a & 1960a). No natural barriers were observed on the South Fork of Scotts Creek nor on Willow Creek between Eight Mile Valley and its confluence with Scotts Creek (DFG 1960b, 1997). In Benmore Creek three "steep cascading rocky barriers as high as estimated 100 ft." in the first two miles above its confluence with the South Fork of Scotts Creek present a barrier to fish passage. The 1959 stream survey notes that no "rough fish" were seen above the first barrier (DFG 1959b).

A 1960 survey found a man-made barrier in the form of a rock masonry dam approximately 5 feet tall and 30 feet long on the South Fork of Scotts Creek approximately ¾ mile downstream from the Hopland Grade Highway crossing (DFG 1960b). Another barrier present today, but not noted in a 1959 DFG stream survey, is a 4 foot high man-made barrier created by the footing of a private bridge on Scotts Creek. This barrier is located approximately 13.4 miles upstream of the mouth of Scotts Creek in the north end of Scotts Valley (Figure 6-1, Plate 2). A culvert under Hendricks Creek road at an unidentified tributary to Hendricks Creek is also a barrier to fish passage. A complete survey of man-made barriers to fish passage has not been done for the watershed.

Figure 6-1 Bridge footing and Decker Bridge, July 6, 2007.
Photo by Erica Lundquist

6.3 Climate

California's North Coast has a Mediterranean climate with moderate, wet winters and warm to hot, dry summers. For the lower Scotts Creek Watershed long term weather records from the nearest weather station in Lakeport, immediately east of the main portion of Scotts Valley at an elevation of 1,340 feet, are shown in Figure 6-2. In the upper watershed, the weather station at Lyons Valley is located approximately mid-way down the west side of the watershed at an elevation of 3,200 feet (Figure 6-3).

The time periods for which data were available at these two stations are different (1971-2000 in Lakeport and 1988-2008 in Lyons Valley), however, there do appear to be consistent differences. Maximum temperatures appear to be higher and minimum temperatures to be lower at the Lyons Valley station compared to the Lakeport station. The total average annual precipitation was very similar at the two stations for the periods of record, 34.1 inches at Lakeport and 33.6 inches at Lyons Valley. This similarity is not expected as rainfall is expected to increase at higher elevations due to orographic lift. Predicted rainfall shows total annual rainfall increasing with higher elevation, ranging from 33 inches per year at the bottom of the watershed to 55 inches per year at the highest point in the watershed (Plate 7). The weather station at Lyons Valley is serviced once a year by BLM personnel from the Boise, Idaho BLM Fire Center. At lower elevations in the Scotts Creek Watershed, snow fall is rare, and almost all precipitation occurs as rain. At higher elevations snow fall occurs in most years, however amounts rarely exceed a few inches in depth and snow storage has minimal impact on the hydrologic balance.

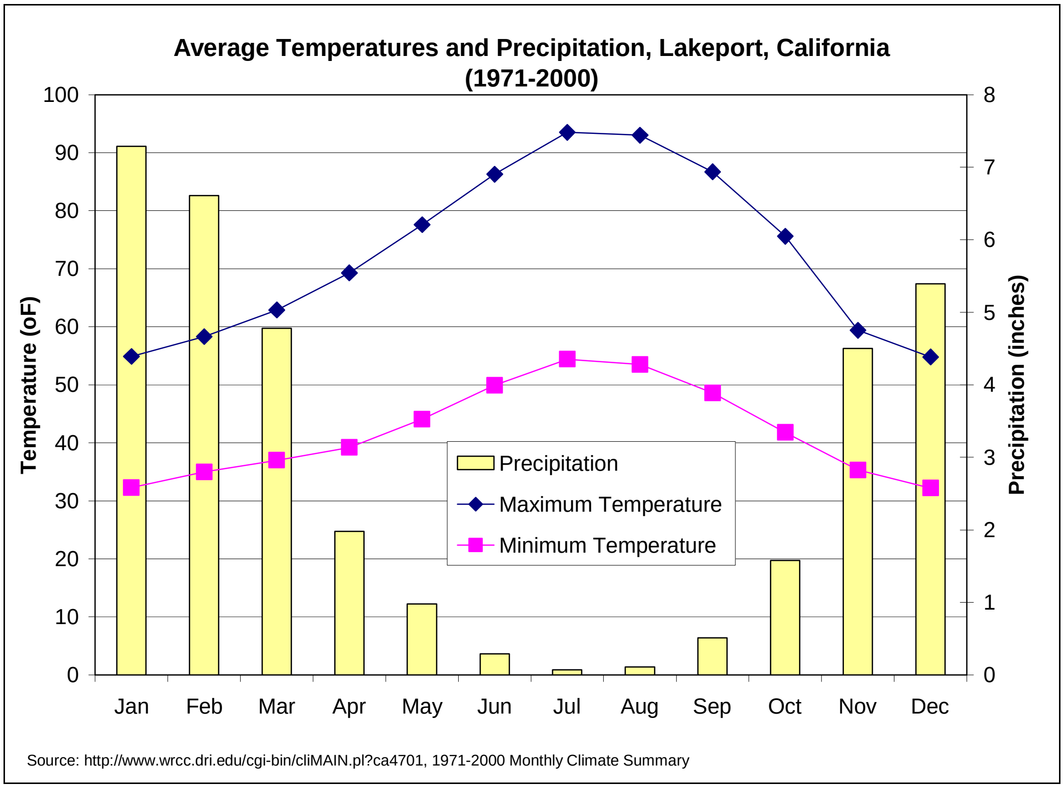

Figure 6-2 Average monthly high and low temperatures and total precipitation for Lakeport, California, near the Scotts Creek Watershed.

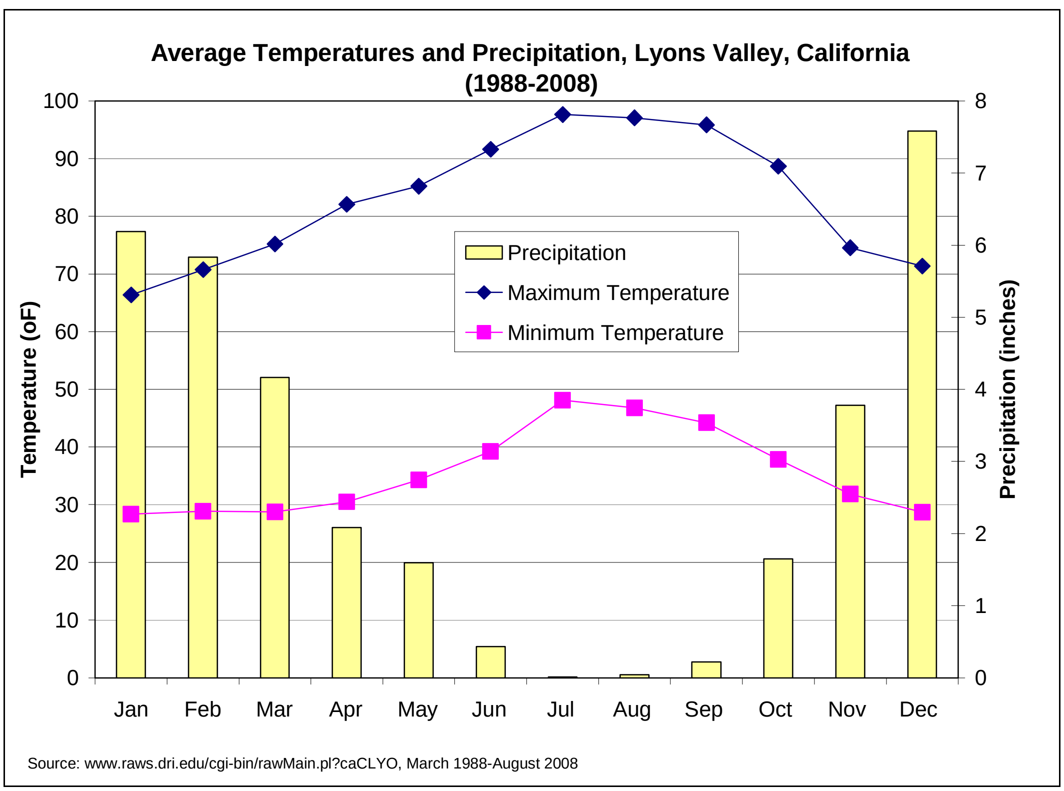

Figure 6-3 Average monthly high and low temperatures and total precipitation for Lyons Valley, California, western side of Scotts Creek Watershed.

6.4 Streamflow

There is one stream gage on Scotts Creek, located just upstream of the Eickhoff Rd. Bridge. This station covers streamflow coming from approximately 50% of the watershed (Plate 2). The average annual flow for this gage, shown in Table 6-2, encompasses dry periods and all flow rates over the entire year. Assuming that streamflow in the remainder of Scotts Creek would be proportional to watershed area; the total flow for Scotts Creek at its mouth would be 159 cfs or 115,116 acre-ft/year.

Table 6-2 Summary of stream gage data.

Operating Agency & Station No.	Location	Average Annual Flow (cfs)	Period of Record (years)	Gage Area (miles^2)
DWR A81845*	12 miles from mouth, 200 feet above Eickhoff Rd.	83.0	1962-2008	55.2

*Prior to 1968, data are from Department of Water Resources station No. A81850 located 200 feet upstream of Scotts Valley Rd. Bridge. Data for average annual flow and charts below are combined from the two stations.

In Figure 6-4, annual average flows are shown by water year[3]. Annual average flows in Scotts Creek vary greatly depending on annual precipitation. During the period of record it ranged from 0.1 cfs in 1977 to 217 cfs in 1998. The state Department of Water Resources (DWR) did not operate the stream gages during the 2006 year water year, and therefore the annual flood that included the "New Years Flood" at this time was not measured (Figures 6-4, 6-5).

Flows were low during the two most recent years of record, 2007 and 2008. The peak stream flows for each water year are shown in Figure 6-6. These are instantaneous flows (measured every 15 minutes), rather than the average flow for the entire year, so they are much higher than annual average flows. Statistical analysis of these peak flows is used to estimate the size of floods expected to occur at a 100 year or other frequency. For example, the 100 year peak flow (or 100-year flood) has a one in one hundred (1%) chance of occurring in any given year. In Figure 6-5 the 1.5 and 100 year peak flows are shown. The 1.5 year recurrence interval corresponds approximately to the bankfull stage of stream flow, or the flow at which the stream is flowing to the top of its banks (Figure 6-7). This flow level is most important in forming the stream channel (Leopold, L.B. 1994). The 100 year peak flow corresponds to what is termed the 1% annual chance flood or the 100 year flood.

[3] The water year goes from October 1 to September 30 and is designated by the year in which it ends. Annual average flow indicates the flow rate averaged over an individual year. Average annual flow indicates the long term (many year) average of annual average flows.

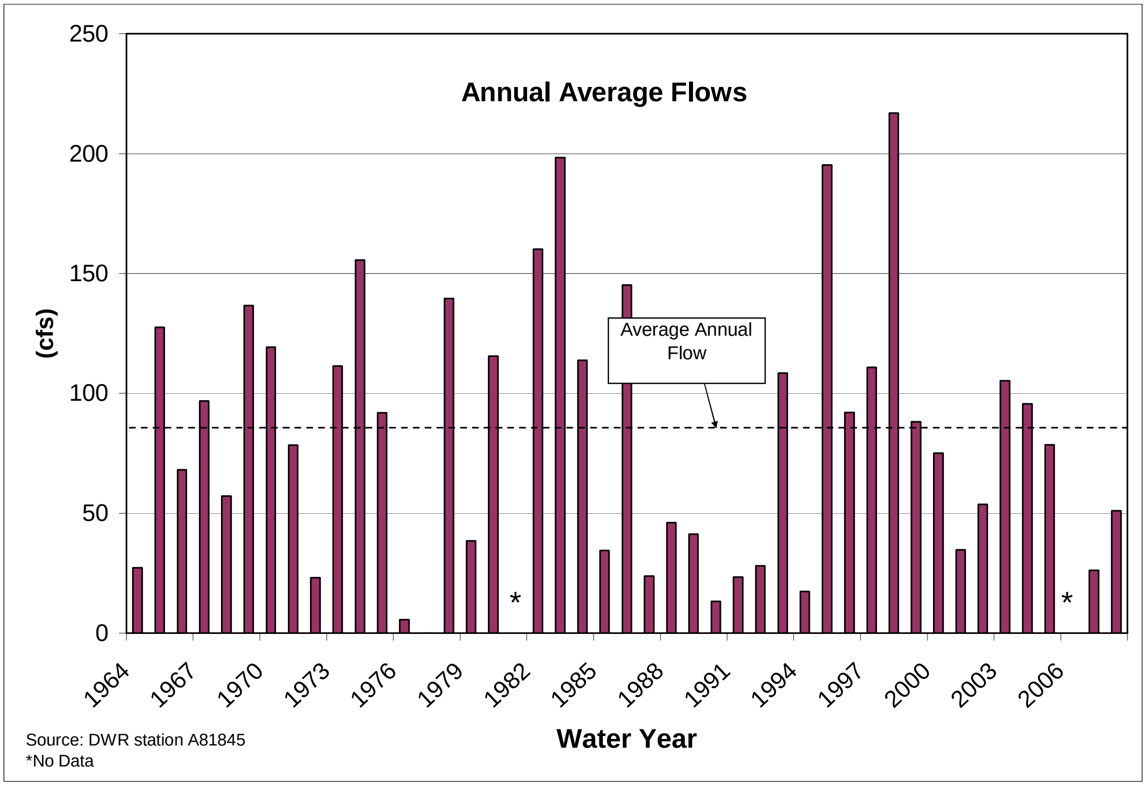

Figure 6-3 Annual average streamflows in Scotts Creek at the DWR stream gage at Eickhoff Rd.

Figure 6-4 High flow in Scotts Creek north of Scotts Valley Bridge during the 2006-2007 "New Years Flood". *Photo by Greg Dills.*

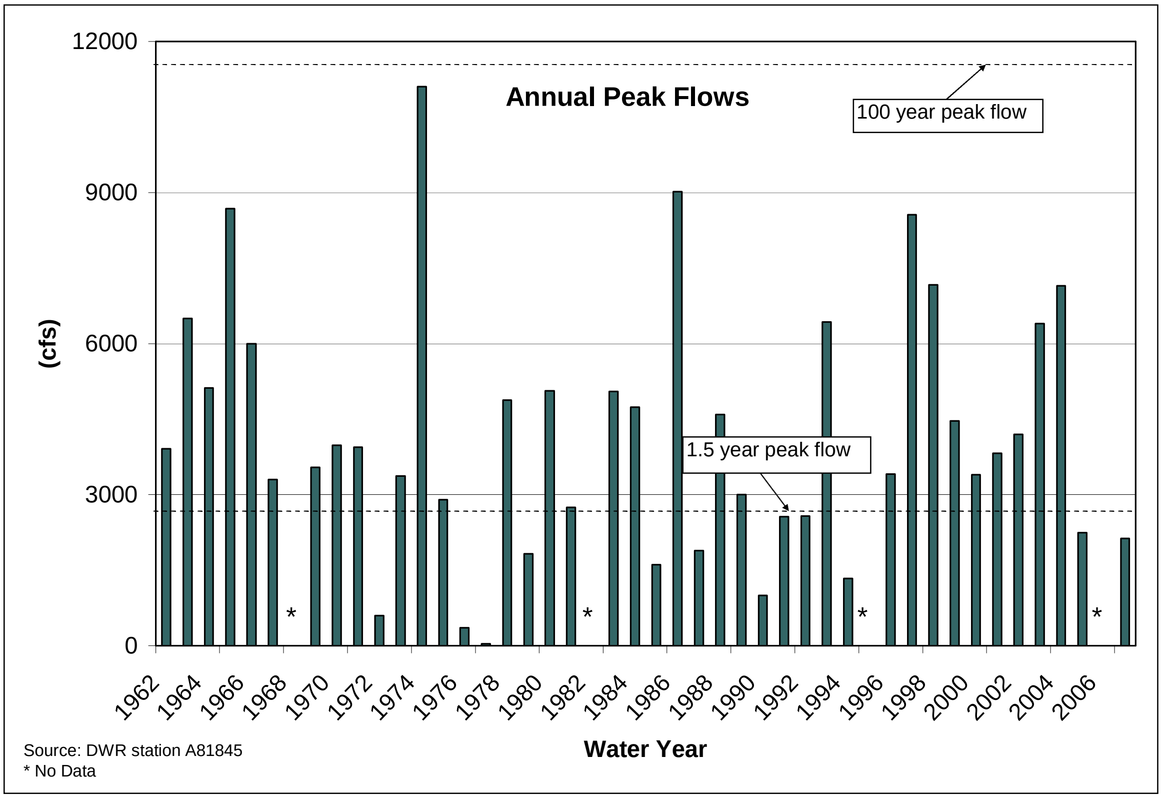

Figure 6-5 Peak flows in Scotts Creek at the DWR station at Eickhoff Rd.

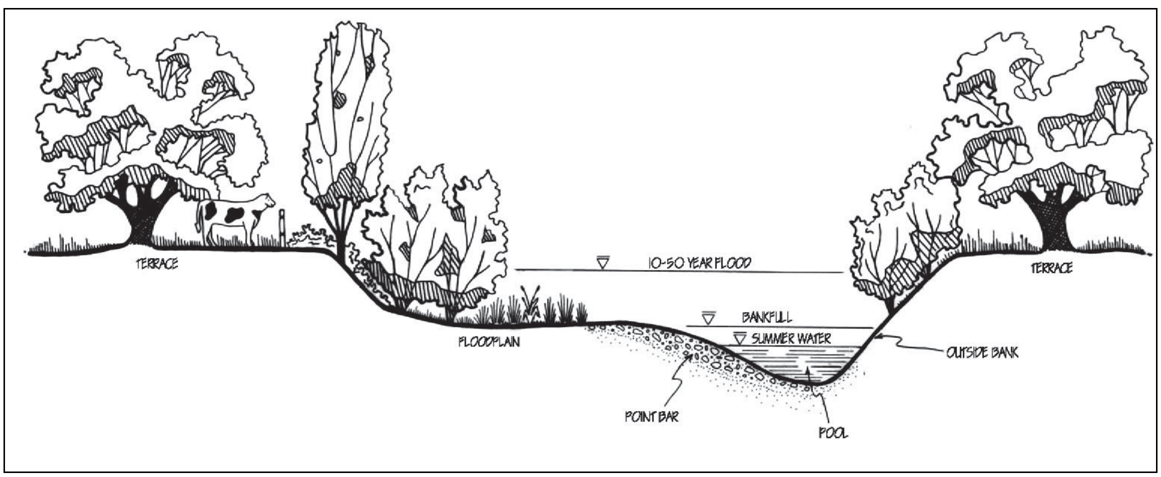

Figure 6-6 Cross-section of a stream channel. (Figure courtesy of Marin Resource Conservation District, 2007).

Monthly average streamflows are shown in Figure 6-8. The seasonal pattern of streamflow matches fairly well with the seasonal patterns of precipitation (Figures 6-2, 6-3) with the exception that substantial rainfall occurs in October, however significant streamflow is not observed until November at the Eickhoff Rd. station (Figure 6-8).

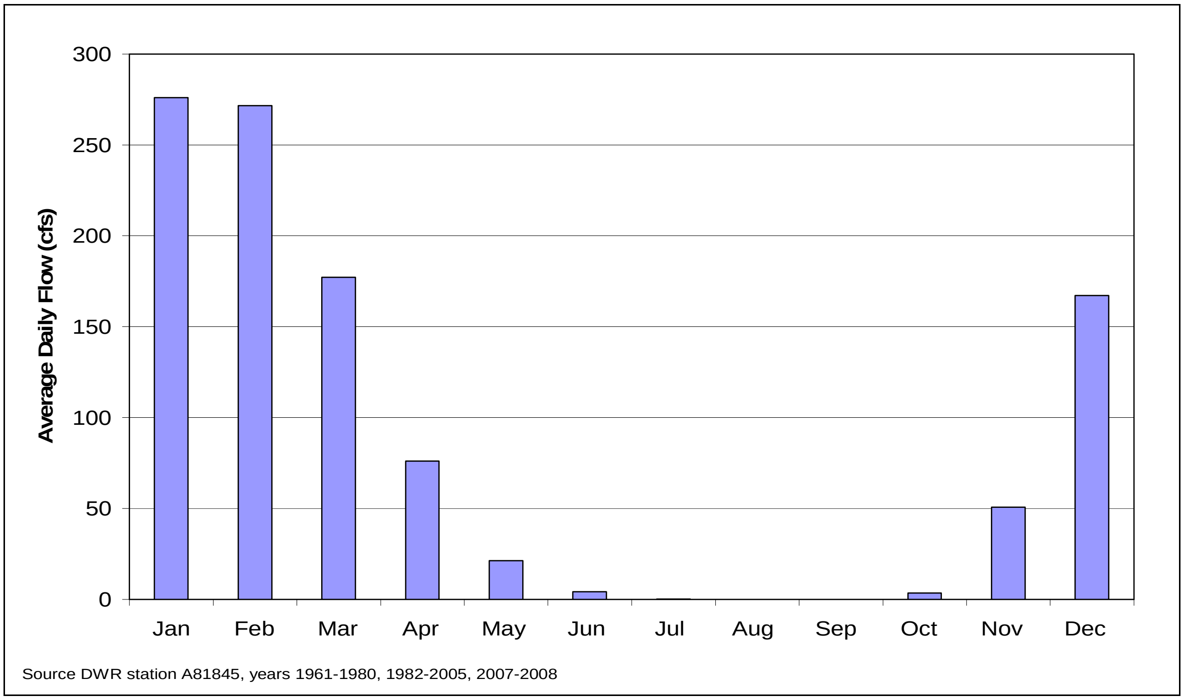

Figure 6-7 Monthly average streamflow for Scotts Creek at Eickhoff Rd.

6.5 Groundwater

The most significant groundwater resource, and the only one that has been well documented, is the aquifer underlying Scotts Valley. Total groundwater storage in the aquifer is estimated to be approximately 5,900 acre-feet, and usable storage is estimated to be 4,500 acre feet. It is estimated that recharge of the aquifer occurs at a rate of 1,000 acre-feet per month when Scotts Creek is flowing, and that the groundwater basin recovers (re-fills) completely during most years (Wahler & Associates 1970).

As discussed in the geology section above, the Scotts Valley aquifer was deposited when the base of Scotts Valley was considerably lower. It consists of slightly cemented sand and gravel. In the northern end of the valley the aquifer is approximately 3-10 feet thick and is overlain by 80-100 feet of lake deposits. At the southern end, the aquifer is 40-70 feet thick, and is in contact with the channel of Scotts Creek. The northern portion of the Scotts Valley aquifer, occupying 2.4 square miles or 83% of the valley floor, is confined. This means that the aquifer it is overlain by impervious materials and is not in hydraulic contact with overlying waters. The southern portion of the aquifer, approximately 0.5 square miles in area, is largely unconfined, although there are lenses of impermeable clay lake deposits, especially near the ground surface. The unconfined aquifer area is in good hydraulic contact with the confined area and is the principal recharge area for the entire aquifer.

Most of the groundwater recharge to the Scotts Valley aquifer occurs as surface water flow in Scotts Creek percolates to the free groundwater table. This occurs from where Scotts Creek enters the level portion of Scotts Valley for approximately 5,000 feet to near the intersection of Scotts Valley Rd. with the southern end of Hendricks Rd. Limited recharge also comes from direct rainfall, percolation from lesser drainages, from bedrock fractures around the valley, and perhaps from unused irrigation waters. Groundwater movement in Scotts Valley is generally toward the north (Wahler & Associates 1970).

Unlike aquifers which are depleted over a series of years, the Scotts Valley aquifer is unusual in being of limited size, and being fully recharged in most years. In comparison to the estimated usable storage of 4,500 acre-feet, current estimates of water use from the aquifer are 2,370 acre-feet per year (Section 9). However, estimated annual extraction was 3,800 acre-feet in 1970 (Wahler & Associates 1970), and was probably greater when pear acreage peaked in the 1980s. During the drought years of 1977 and 1978, the water supply was insufficient to satisfy irrigation needs (SVWCD 1988).

7.0 Hillslope and Stream Channel Geomorphology

Geomorphology is the study of land forms and the processes that shape them. Hillslope processes influence the formation of stream channels and valleys, so this section begins with hillslope processes.

7.1 Soil Erosion and Sedimentation

Erosion is a natural geologic process. Through erosion, hills and mountains are gradually worn down and sediment is deposited in valleys, lakes and bays. Accelerated erosion occurs through human activities such as livestock grazing, cutting forests, plowing sloping land, disturbing land for construction of roads and buildings, stream channelization, and development that reduces land permeability and concentrates streamflows. Accelerated erosion damages soil when topsoil is lost and increases sediment loads in streams and lakes, which reduces water quality. (Section 8)

Several factors influence erosion of the soil surface. Surface erosion is generally inconsequential on level ground and increases as the slope of the land increases. There is also greater erosion potential as the length of sloping ground increases. The amount and intensity of rainfall influence erosion as do soil properties such as texture and permeability. Cover by vegetation or other materials has a major influence on soil erosion. Bare soil is much more likely to erode, and covering it with living vegetation, mulches or other materials is one of the best erosion control methods. Other soil conservation practices include contour tillage and construction of terraces.

Landslides are the down slope movement of large masses of sediment and rocks, largely due to gravity. They can be set off by natural causes such as heavy rainfall, earthquakes, floods, and by human activities such as grading, terrain cutting, and filling. Three factors contribute to the potential for landslides, the steepness of the terrain, consolidation of the materials that make up the slope, and the amount of water which loosens the materials (USSARTF 2008). Landslides have the potential to cause sporadic, but very large sediment loads to stream systems.

Roads, especially unpaved roads, can be major sources of erosion. Surface erosion from roads can be a chronic source of fine sediment. Road failures, especially when large storm events cause multiple failures, contribute large sediment loads to streams. Operation of motorized vehicles off of developed roadways and trails contributes to both hillside and streambank erosion. Streambank erosion is discussed in Section 7.4.

Agricultural tillage both loosens soil and removes soil cover. It increases erosion risk primarily on sloping ground. The two crops commonly grown on sloping ground in Lake County are walnuts and wine grapes, however there is very limited hillside acreage of these crops in the Scotts Creek Watershed. While livestock grazing can remove vegetative cover leading to erosion on hillsides, the greatest erosion impacts of livestock may be damage and removal of riparian vegetation and stream bank erosion. There are numerous resources describing best management practices for road building, construction site, and farming practices to prevent surface erosion and landslides (Appendix A).

Developed areas, even at low densities, contribute to increased long term erosion potential. In these areas, impervious surfaces increase surface run-off, and flows are concentrated in ditches and other water conveyance structures. Streams are frequently channelized, straightened and/or deepened, for development or agricultural purposes. Channelized streams have the potential to carry higher peak flows and therefore greater sediment loads. Higher peak flows also contribute to greater downstream flood potential.

As discussed in Section 3, the impacts of human activities on soil erosion in the Clear Lake watershed became obvious following the advent of heavy earth-moving equipment in about 1927 when sedimentation rates to the lake increased approximately 10-fold.

7.2 Erosion Hazard Analysis

Two erosion hazard analyses were carried out by NRCS personnel for the Scotts Creek Watershed. The first was the potential for surface erosion in areas where the land surface has been disturbed, and the second was soil slippage risk. Details of the data and calculations used to generate the analysis and plates are included in Appendix B.

Surface erosion risk following disturbance (Plate 8) was determined assuming that disturbance activities have exposed 50-75% of the mineral soil surface. These activities could include forestry practices, grazing, mining, fire, firebreaks, etc. The analysis places soils in the following four categories: SLIGHT indicates that erosion is unlikely under ordinary climatic conditions; MODERATE indicates that some erosion is likely and that erosion-control measures may be needed; SEVERE indicates that erosion is very likely and that erosion-control measures, including re-vegetation of bare areas, are advised; and VERY SEVERE indicates that significant erosion is expected, loss of soil productivity and off-site damage are likely, and erosion-control measures are costly and generally impractical.

Soil slippage risk (Plate 9) is the possibility that a mass of soil will slip when these conditions are met: 1) vegetation is removed, 2) soil water is at or near saturation, and 3) other normal practices are applied. Other factors could increase the risk of soil slippage, but they are not considered here. Examples of these other factors are: 1) undercutting lower portions or loading the upper parts of a slope, or 2) altering the drainage or offsite water contribution to the site such as through irrigation.

Areas with severe and very severe erosion risk following land disturbance and with high soil slippage risk are concentrated on sloping grounds in the upper watershed, while level areas in the lower watershed have very low risk of erosion or soil slippage (Plates 8, 9).

There are 48 miles of paved and 334 miles of unpaved roads in the Scotts Creek Watershed (Plate 10). Roads and trails have a greater potential to cause erosion and sedimentation when located in areas of high erosion hazard, high soil slippage risk, or near water courses.

7.3 Stream Channels

Stream channel form and stream processes tend to change from the headwaters of a stream, creek, or river to its mouth. The longitudinal profile of a stream from its headwaters to outlet can be divided into three zones (Figure 7-1). In Zone 1, the headwaters zone, the gradient, or slope of the stream is greatest. This zone is dominated by erosion of sediments which are transferred downstream. Zone 2, the transfer zone, receives some of the eroded material from Zone 1, and therefore usually has a floodplain and a meandering channel pattern. In Zone 3, the depositional zone, the stream gradient flattens to nearly level, and most eroded material is deposited. It is characterized by a broad, nearly flat valley with a meandering channel (USDA NRCS 1998).

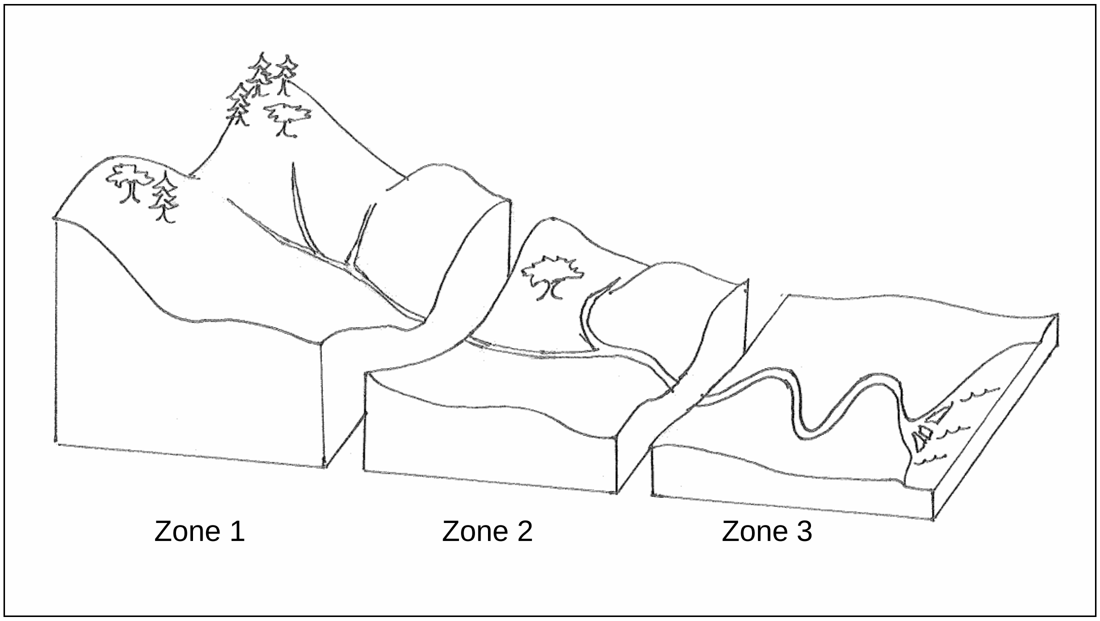

Figure 7-1 Longitudinal profile of a stream.

In Zone 1 stream size is typically small, and streams flow through v-shaped valleys with no floodplains. Therefore the upland plant community is found adjacent to the stream. Where forests occur they may form a canopy over the stream. Stream water temperatures tend to be relatively cold and stable due to groundwater recharge. Zone 2 has a wider channel and more complex floodplain than Zone 1. Plant communities adapted to periodic flooding are present in the floodplain. As the channel widens, the stream is exposed to more sunlight which causes larger daily water temperature fluctuations, and an increase in the average water temperature. In Zone 3 large floodplain wetlands may be present because of the flatter terrain. In addition valley hardwoods create productive and diverse riparian communities in the deep alluvial soils.

Stream channels often have a naturally occurring sinuous, or curving, channel form (Figure 7-2). Sinuosity tends to be low to moderate in Zones 1 and 2 and moderate to extremely sinuous in Zone 3. The sinuous pattern creates diverse aquatic habitats with an alternating series of pools at the bends of the watercourse and riffles (shallow, gravelly areas) in between the bends. The stream form is dynamic with the curves and channel migrating over the floodplain. This movement of the stream channel creates a diverse riparian community with both older stages of vegetation on the outer curves, and new stages on the newly deposited point bars on the inside of the curves (USDA NRCS 1998).

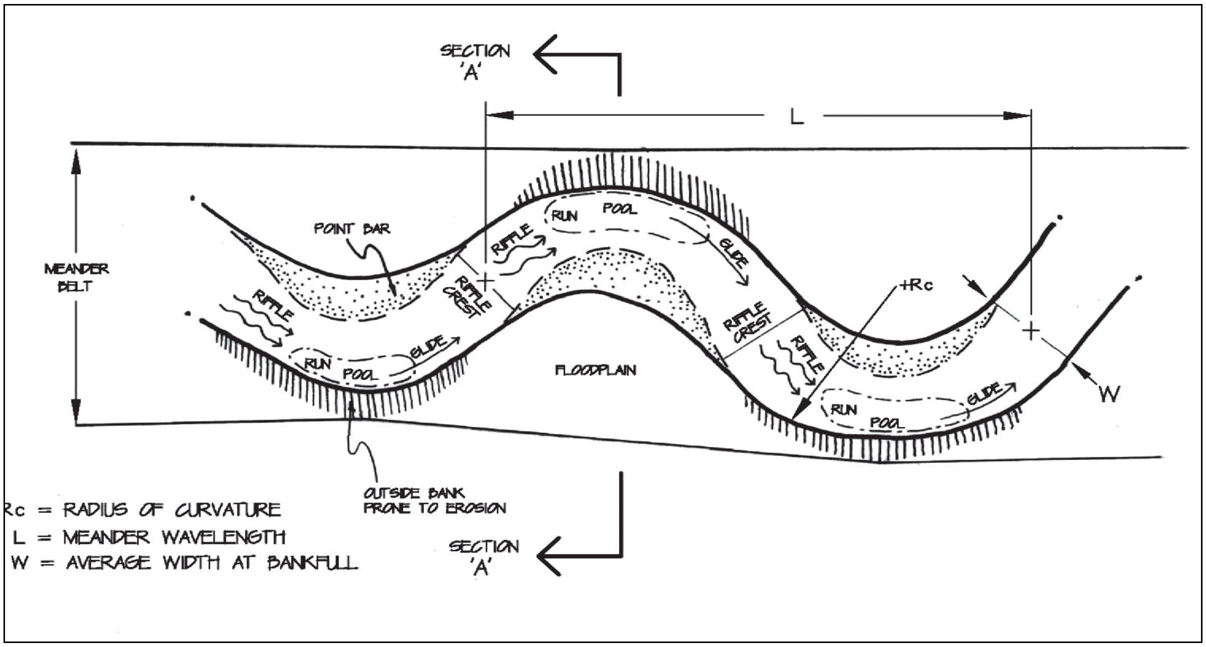

Figure 7-2 Stream pattern. Figure courtesy of Marin Resource Conservation District, 2007.

7.4 Activities Influencing Stream Channels

Many flood control practices alter stream channels and reduce habitat values for aquatic and terrestrial wildlife. Straightening and deepening, or channelization, of streams and rivers is often done for flood reduction and to “square up” agricultural fields and roads. Channel vegetation is also removed to increase water flow and prevent flooding. Straightening disrupts the pool and riffle sequences that are important components of aquatic habitat. Straightening reduces the length of a stream, although the overall change in elevation does not change. Therefore it increases the stream gradient (slope) and the velocity of water moving through the stream channel. Increased water velocity in turn causes increased scouring and channel deepening. Construction of floodwalls and levees can increase stream velocity by constraining high flows to a narrower channel and allowing greater flood heights. Removal of large, woody debris for flood protection eliminates important aquatic habitat for fish and the aquatic insects that they feed on (Leopold, L.B. 1997, USDA NRCS 1998).

Other activities damage stream channels. In-stream gravel mining involves removal of vegetation, destruction of in-stream habitat and alteration of the stream channel. Extensive gravel mining can lower stream channels with consequences for groundwater tables and recharge. Livestock are attracted to streams for water and often for shade. Their use of streams leads to loss of vegetation and increased streambank erosion, as well as potential fecal contamination of water. OHV use of stream channels and the surrounding riparian areas damages streambank vegetation, and contributes to streambank erosion.

Several land use activities have the potential to reduce soil permeability and water infiltration. During storm events, this leads to increased run-off, which reduces the amount of water available for groundwater recharge and sustained streamflows. Reduced soil permeability therefore leads to more "flashy" stream flows with higher flood peaks, greater erosion potential, and reduced sustained flows. Urban areas with impermeable surfaces contribute to flashy stream flows. Forestry, livestock grazing, and agricultural practices have the potential to reduce soil permeability, although management practices can lower or eliminate this potential.

Water diversions for irrigation and other purposes reduce streamflows and may obstruct fish passage. Reduced water availability can have detrimental effects on water quality and aquatic organisms as discussed in Section 8.1.

7.5 Upper Scotts Creek Watershed Channel Conditions

For the purposes of this assessment Upper Scotts Creek is defined as the portion of the creek above the confluence with the South Fork of Scotts Creek. Other streams such as the South Fork of Scotts Creek, Benmore Creek, tributaries to upper Scotts Creek, and the upper portion of Cooper Creek are likely to have similar conditions to those of the higher reaches of Scotts Creek.

A 1959 DFG stream survey described the channel of upper Scotts Creek to its confluence with the South Fork of Scotts Creek (called Manley in this survey). "The Stream heads in a rugged mountainous area covered by chamise and manzanita. Occasional stands of oak and conifers are found in the north slopes. In the extreme headwaters the stream flows through a deeply incised channel lined with hardwoods downstream for approximately two miles. For the next 6 miles the stream flows through a narrow non-incised plain of boulders and gravel." For the next 3 miles "the stream flows through a wide flood channel of gravel bottom. The gradient from the extreme headwaters to Manley is only slight. Oaks and other hardwoods line the banks along the entire length of the stream" (DFG 1959a).

A 1997 survey described Scotts Creek from Willow Creek to the confluence with the South Fork. "The streambed in the surveyed reach was generally flat-bottomed V-Shape, with side areas gradually rising to steep canyon walls. The stream channel was generally sinuous, dominated by low gradient riffles and pools…Vegetative cover adjacent to the stream consisted mainly of clusters of willow and alder, with extensive stands of sedges that concealed the stream channel in many of the more open areas" (DFG 1997a). No mention of oaks and other hardwoods on the streambanks is made in this survey. Descriptions of surrounding vegetation are similar in the two surveys.

Figure 7-3 Shaded and unshaded portions of Upper Scotts Creek, 1996.
Photos by Jared Hendricks, Jr.

Scotts Creek flows year round in much of the upper watershed. In most years the lower reaches dry up in the summer starting at about 1.5 miles above the junction with the South Fork of Scotts Creek. In dry years, or years when precipitation stops early in the year, the creek dries to higher elevations. Streamflow was low during the 2007 and 2008 water years (Figure 6-4), and there was relatively little spring precipitation during these years. During the summer of 2008, Scotts Creek was dry at least up to the confluence with Willow Creek. This was the longest dry stretch in the experience of long-time watershed resident Jared Hendricks Jr.

Stream channelization occurs primarily in level valleys. Benmore Creek has been straightened through Benmore Valley in the southern watershed. Channelization is visible in 1952, and additional channelization is visible by 2006 (See photos Appendix C).

Eight Mile Valley, on BLM land at the headwaters of Willow Creek, is a mountain valley where stream modifications have caused major erosion and sedimentation. Farming and ranching began in the mid 1800s, and channels that once flowed through the center of the valley were routed around the perimeter of the valley, creating gullies averaging 12 feet deep. An artificial channel dug across the western edge of the valley also created a 10 foot deep gully. The deep gullies have lowered the water table in the valley resulting in reductions in riparian and wetland vegetation and aiding the establishment of non-native invasive plant species. (See photos Appendix C.) The lower water table has reduced the period of water flow in stream channels, eliminating fish habitat in the valley (Arriaza 2005).

A major restoration project was attempted in the summer of 2005 to stop the gully erosion and restore hydrologic function to the valley. BLM hired Terry Benoit of the Feather River Coordinated Resource Management Group (Plumas Corporation) and Rau and Associates of Ukiah to design and install a "plug and pond" system. This system relied on creating ponds and using the fill material to fill the gullies to the elevation of the adjoining meadow. In addition all five tributaries were redirected into historical remnant channels, and a rock control structure was built at the confluence of the gullies to protect an area of elevation change.

Major storms in December 2005 and January 2006 (which resulted in state and federal disaster declarations in Lake and Mendocino Counties) led to a failure of the restoration efforts. Consequently "the restoration area is experiencing significant erosion, channel incision, and bank instability. Left alone, this erosion process will continue to propagate through the meadow as the system adjusts to a new equilibrium" (Winzler and Kelly 2008).

The BLM is currently pursuing grant funds to re-design and implement a long term solution to stabilize the valley channel system (Frank Arriaza, personal communication).

7.6 Lower Scotts Creek Watershed Channel Conditions

Channelization of Scotts Creek apparently occurred in the 1870s to 1890s throughout the wide portion of Scotts Valley. The first available aerial photos (1940) show a relatively straight course of Scotts Creek through Scotts Valley and continuing northward in 1940 (Appendix C). A history of Scotts Valley gives this account of Scotts Creek, how it came to occupy its current channel in Scotts Valley, and how levees or "banks" were built up to carry floodwaters:

> "But during all this time Scotts Creek was a great worry[4]. Every winter when the high waters came the creek would take a new course and wash away a lot of someone's soil...To complicate matters, there came along a very rainy winter and the Valley was covered with water. Some big trees were cut and fell in the wrong places, and the current of water was diverted. When the water receded there was a very decided channel cut much farther east than it had ever been before. It was so deep and clear-cut that it was decided to leave it there… It took many years to get a bank high enough to carry the water along through the winter storms… Even of late years there have been times when the water would break through and go on a rampage over the lower ranches" (Deacon 1948).

[4] Earlier in the text the author makes clear that the time referred to is the 1870s to 1890s.

Another example of creek straightening is visible immediately upstream (south) of Blue Lakes on Scotts Creek. The 1940 aerial photo of this section of creek reveals traces of past stream courses in the patterns of vegetative growth in the adjacent pasture (Appendix C). This straight portion also contrasts with the meandering channel upstream.

A 1960 DFG stream survey gave this description of Scotts Creek from the confluence with the South Fork to its mouth:

> "This portion of stream surveyed heads in a 150 ft. wide stream channel bordered by steep precipitous mountains with the main stream channel slightly incised below the bordering channel level, and flows downstream for approximately 1.5 miles out into a broad agricultural flood plain for approximately 2 miles. Through this broad plain the stream channel is approximately 50 ft. wide and incised to depths of 10-12 ft. The stream bank is bordered throughout with moderate to heavy stands of willow cottonwood, alder and blackberry bushes. From this point the stream flows into a narrow agricultural flood plain averaging approx. ¼ mile in width with an incision bordered by dykes in a few locations of 10 to 12ft. in depth for approximately 7.5 miles out into a wide agricultural plain approximately 2 miles in length then 1.2 miles in width. From this point downstream for approximately 3.2 miles the stream flows through a channelized stream bed, dyked and dredged for flood control purposes out into Clear Lake. The entire drainage to which this section of stream passes is agricultural land bordered by steep mountains."

The lower section of Scotts Creek (18.3 miles from the confluence with the South Fork to the mouth) was surveyed in 1985 for the Lake County Aggregate Resource Management Plan (ARMP) (LCPD 1992). The upper section from the confluence 2.3 miles downstream to Scotts Valley was described as follows: "The channel becomes wide, shallow, and braided. In places it is as much as 300 feet wide. The riparian woodland has been lost throughout this area." This section has "undergone extensive channel widening and degradation over the past 23 years. In 1967, approximately 500,000 cubic yards of aggregate were removed from this portion of the creek for the Highway 29 bypass." The survey further states that "in 1981 channel degradation of as much as three to four feet extended into the valley for at least two miles." Most of the streambanks surveyed in the 1987 ARMP from the confluence to the mouth were described as "steep" or "vertical".

Aerial photos of the area around the Scotts Creek confluence from 1940 to 2006 do not support the ARMP description of channel widening (Appendix D). As early as 1940, this section of Scotts Creek was a wide, gravel channel.

In fact the photos appear to show a narrower, deeper channel after gravel mining in some sections. The arrow in the 1940 photo points to an area that appears to be a floodplain. In subsequent photos, especially by 1970, the channel has deepened and narrowed in this area, and the floodplain has become a terrace.

Streambank erosion from the terraces in the confluence area is a continuing problem and has been documented in photographs over the past 5 years (Figure 7-4, Greg Dills, personal communication). The most visible demonstration of this erosion in the aerial photographs is the terrace indicated by an arrow in 1970, which is no longer visible in 2006 (Appendix D).

Figure 7-4 Streambank erosion on terrace near Scotts Creek confluence in May 2004 (top left), February 2005 (top right) and October 2006 (bottom). *Photos by Greg Dills.*

Well logs provide evidence that the extensive gravel mining lowered the channel of Scotts Creek and reduced groundwater storage. Figure 7-5 shows spring and fall well levels from a well approximately 900 feet east of the Scotts Valley Rd. Bridge. The spring water levels indicate the surface of the groundwater table when it is full, and it can be seen in Figure 7-5 that the level dropped approximately 3 feet from the early 1950s to the early 1970s following the gravel mining for Highway 29. The stream channel in the area of Scotts Valley may have continued to degrade (down-cut) in Scotts Valley after this period as the groundwater surface level dropped an additional 3 feet by the 1980s. The recent increase in the groundwater surface level in 2005 and 2006 may have been due to the wet spring conditions in those years or may indicate that gravel is beginning to accumulate in the channel. Additional years of measurement will be needed to determine whether they indicate that the stream channel has begun to aggrade (rise). Lower spring water levels in 2007 and 2008 are probably due to dry spring conditions in those years.

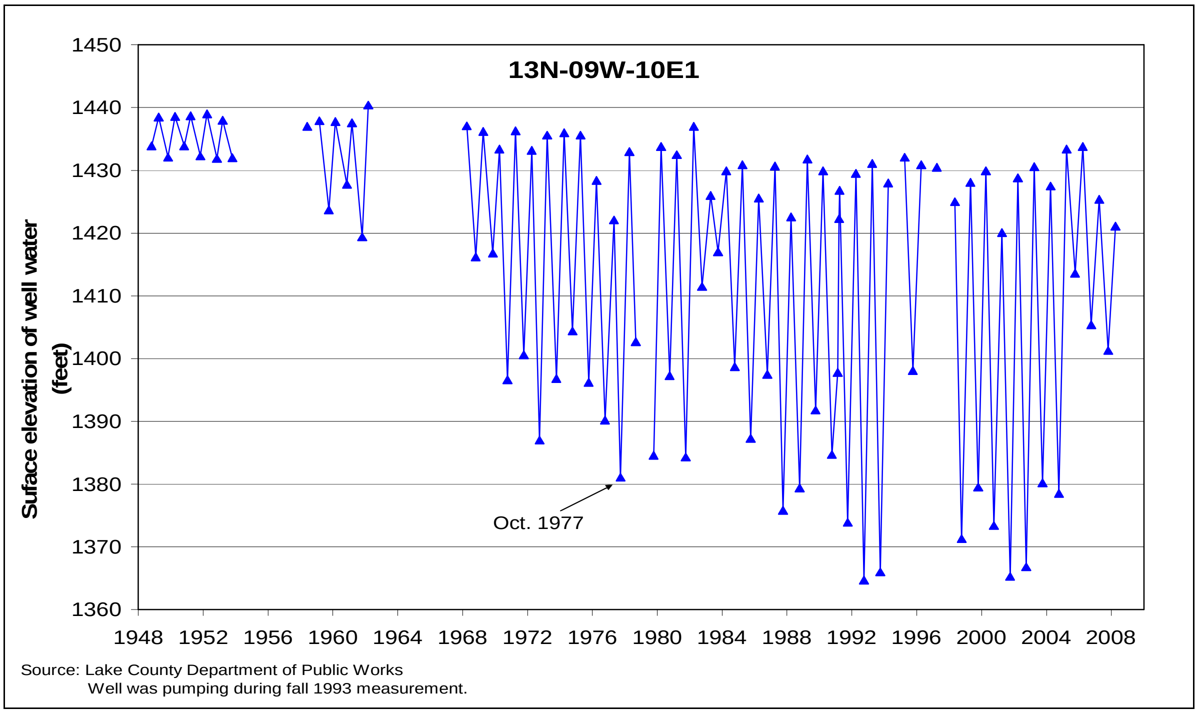

Figure 7-5 Well water levels from a well located approximately 900 feet east of Scotts Valley Rd. Bridge.

As part of the Scotts Creek Watershed Project (1995-1997) three streambank rehabilitation projects were installed, one on the South Fork of Scotts Creek just above the confluence of the two forks, and two approximately 2,800 feet and 6,450 feet downstream of the confluence. The installation on the South Fork site blew out in January 1997, and the BLM repaired the damage late that year. The “dragon’s teeth” rock weirs stabilizing the west bank of the South Fork of this site appear to have been effective since that time (Greg Dills, personal communication). In the lower two sites, willow cuttings were planted along the streambanks to reduce bank erosion and provide channel confinement and stability. Two years after installation, the re-vegetation efforts appeared to be successful. Some vandalism of the irrigation systems occurred at both sites, and the condition of the lower site highlighted the problems caused by OHV use in the stream channel and on adjacent banks:

"Off-highway vehicles (OHVs) had run over the exclusion fence, plantings and irrigation piping, and established two hill climb trails up the bank" (LCFCWCD 1997).

Given the average total annual flow of Scotts Creek of 115,116 acre-feet, the total water appropriations of 821 acre-feet per year do not appear to be significant enough to affect channel forming processes. Although the amounts of riparian water use are not reported, they are generally smaller than appropriations. Because the timing of diversions is not known, the possibility remains that diversions in spring and summer may lead to earlier cessation of streamflows, affecting spawning fish and other aquatic life.

7.7 Flooding and Floodplain Management

Flooding is a common occurrence from Scotts Valley to the mouth of Scotts Creek. Flood zones as mapped by the Federal Emergency Management Agency (FEMA) are shown in Plate 11. The 1% annual chance flood zone means that there is an estimated one percent chance of a flood in any given year. In the past the zone was referred to as the 100 year flood zone, because on average a flood occurs once every 100 years in this zone. Likewise the 0.2 percent annual chance flood indicates a flood on average once every 500 years. Flood Zone D is the area of undetermined flood hazard, and flood Zone X is an area with 500 year flood hazard zone or 100 year floods with less than one foot water depth. As more information on flood levels is gathered, these flood zones may be altered.

Figure 7-6 Extensive flooding occurred during this December 31, 2005 storm. View is toward southeast with Hendricks Rd. in foreground. *Photo by Greg Dills.*

A description of flood prone areas and issues caused by flooding in the Scotts Creek Watershed is given in Table 7-1 below. In most of these areas floodplain development is limited to agriculture, and in many areas the natural benefits of floodplains, flood attenuation, and sediment retention have been retained. Because high flows of Scotts Creek spread out in Tule Lake, the lake has been found to significantly reduce sediment inputs to Clear Lake (Richerson et al. 1994, USACE 1997).

Table 7-1 Areas subject to flooding and issues caused by flooding for the Scotts Creek Watershed.

Subarea	Flood frequency and issues
Mapped flood area above Scotts Valley	Flood flows are contained within the active channel.
Scotts Valley	There is limited channel capacity in the northern half of the valley. Levees along most of Hendricks & Scotts Creeks are privately maintained. Levees fail or the creek overtops levees approximately every 10-25 years causing flood depths of 1-2 feet in the southern end, and more in the northern end due to land subsidence of approximately 3 feet.
Scotts Valley- Hendricks Creek	Limited channel capacity in Hendricks Creek causes flooding over agricultural land to the north and east that enters Scotts Creek below Eickhoff Rd. This contributes to flooding over Scotts Creek Rd.
Scotts Valley to Tule Lake	Frequent flooding occurs (more than once/year on average). Most of the floodplain is undeveloped pasture or hay fields providing natural floodplain benefits of flood attenuation and sediment deposition. Problems with access occur, especially Eickhoff to Hendricks Rds., Laurel Dell Rd. to Highway 20, and residences east of Scotts Valley Rd.
Tule Lake	Floods in all but severe drought years. Was a seasonal lake, reclaimed for agriculture in 1903. Now serves to attenuate floods and retain sediment in winter, for wild rice and cattle grazing in summer.
Tule Lake to mouth at Rodman Slough	Levees on north side of Scotts Creek are part of Middle Creek Flood Control project completed by U.S. Army Corps of Engineers (USACE) in 1966. This levee was overtopped by Scotts Creek in 1995, flooding portions of Highway 20. More frequently lands to north of the levee flood when sustained high flows in Scotts Creek prevent release of water from drainage from the north into Scotts Creek. Land use north of levee is mainly pears and walnuts with little damage from flooding; however, an automobile dismantling business in the area could cause oil contamination of Scotts Creek and Clear Lake.
Laurel Dell Lake	Floods due to limited channel capacity above Tule Lake. Flooding can last several days to weeks, limiting access to Scotts Valley Rd. from Highway 20 and threatening numerous residences and buildings.
Bachelor Valley	Central and upper portions of the valley flood every 3-5 years from Cooper Creek and its tributaries. Lower end floods most years with back water from Tule Lake. Flooding is shallow and does little damage on agricultural lands.

Source: Lake County 2000 and USACE 1972.

Much of the potential harm caused by flooding is due to restricted access where roads are flooded or access to homes is cut off. There are six repetitive loss homes around the lower Blue Lake, Laurel Dell Lake. A repetitive loss property is a flood-prone property identified by the National Flood Insurance Program (NFIP) as having had two or more claims of over $1,000 to NFIP during the previous 10 years.

Flood control levees along Scotts Creek begin at the south end of Hendricks Road and continue downstream to 1.5 miles past Eickhoff Road. Many of these levees were built by private landowners, frequently at the top of the bankfull channel, which cuts the channel off from the floodplain. As part of the Scotts Creek Watershed Project, two private levees that were blown out during the January 9, 1995 flood were reconstructed set back from the channel. These set back levees appear to be less prone to damage and erosion during flood events, and they allow for some dissipation of flood energy as well as riparian growth and sediment storage (LCFCWCD 1997).

Figure 7-7 Flooding during high flows in narrow portion of Scotts Valley, January 1, 2006. High flows frequently lead to flooding outside the stream channel as in this photo. *Photo by Greg Dills.*

Duane Furman, who has lived along Scotts Creek near the Glen Eden trail since 1962, found that the best approach for avoiding property damage during flood events was to allow the creek to spread out in the flood plain. Levees cause greater damage because when they break "You have a tremendous amount of velocity going through the levee and that's when you get all your big drift and gravel". He also recommended maintaining vegetation such as willows along the creek to prevent flood debris from reaching fields. He summarized his experience: "It took us a long time to learn we had to live with the creek instead of trying to fight it." (SVWC 2008).

A multi-use project for flood control, municipal water, groundwater recharge, irrigation, and recreation was proposed on Scotts Creek above Scotts Valley (USACE 1965, 1972). Studies on project design and environmental impacts were continued into the 1970s; however the project was not completed. A scaled down dam and reservoir for flood control were found not to be economically feasible in a 1984 study by the SCS (USDA SCS 1984). Lake County pursued and received water rights for the project; however, these rights were later lost after the project was deauthorized by Congress.

7.7.1 Middle Creek Flood Damage Reduction and Ecosystem Restoration Project (Middle Creek Project)

Since 1995, the LCWPD has been pursuing the Middle Creek Project, a project to acquire 1,650 acres of reclaimed land to restore it to wetlands. This project is located east of the Scotts Creek Watershed, where Scotts and Middle Creeks enter Clear Lake. The project has been identified as the single largest recommended water quality improvement to Clear Lake. It would restore the largest damaged wetland area around the lake, and the restored wetlands would filter water from the Scotts Creek and Middle Creek Watersheds, which contribute an estimated 57% of the inflow and 71% of the phosphorus loading to Clear Lake (USACE 1997). The USACE estimates that phosphorus and sediment inputs from Scotts and Middle Creeks would be reduced 40% by the Middle Creek Project, which amounts to an estimated 28% reduction for Clear Lake as a whole. (See Section 8.3) Eighteen homes and a large area of agricultural land would be purchased as part of the Middle Creek project, and the homes would be removed. These properties would therefore no longer be subject to the economic risk of flooding. The Middle Creek Project would also restore approximately 1,400 acres of wetlands, provide valuable fish and wildlife habitat, and increase the current area of wetlands around Clear Lake by 73% (Figure 7-8).

The USACE completed a feasibility study and environmental documentation (EIS and EIR) for the study in 2002. The Lake County Watershed Protection District (LCWPD) has received $5.714 million in grants from DWR to begin land acquisition in the area, and as of December 2007, 134 acres have been acquired (CLTSC 2008, LCWPD 2007). In November 2007, authorization for the USACE to participate in the Middle Creek Project was passed as part of the federal Water Resources Development Act. Additional federal legislation appropriating money for the project and transferring the "USA In Trust" properties (held in trust for the Robinson Rancheria Band of Pomo Indians) outside of the project boundaries are required. The Lake County Board of Supervisors, LCWPD, and the Robinson Rancheria Tribe have been lobbying federal representatives to pass this legislation. California Assembly Bill 74, authorizing state participation in the Middle Creek Project, passed in October 2009.

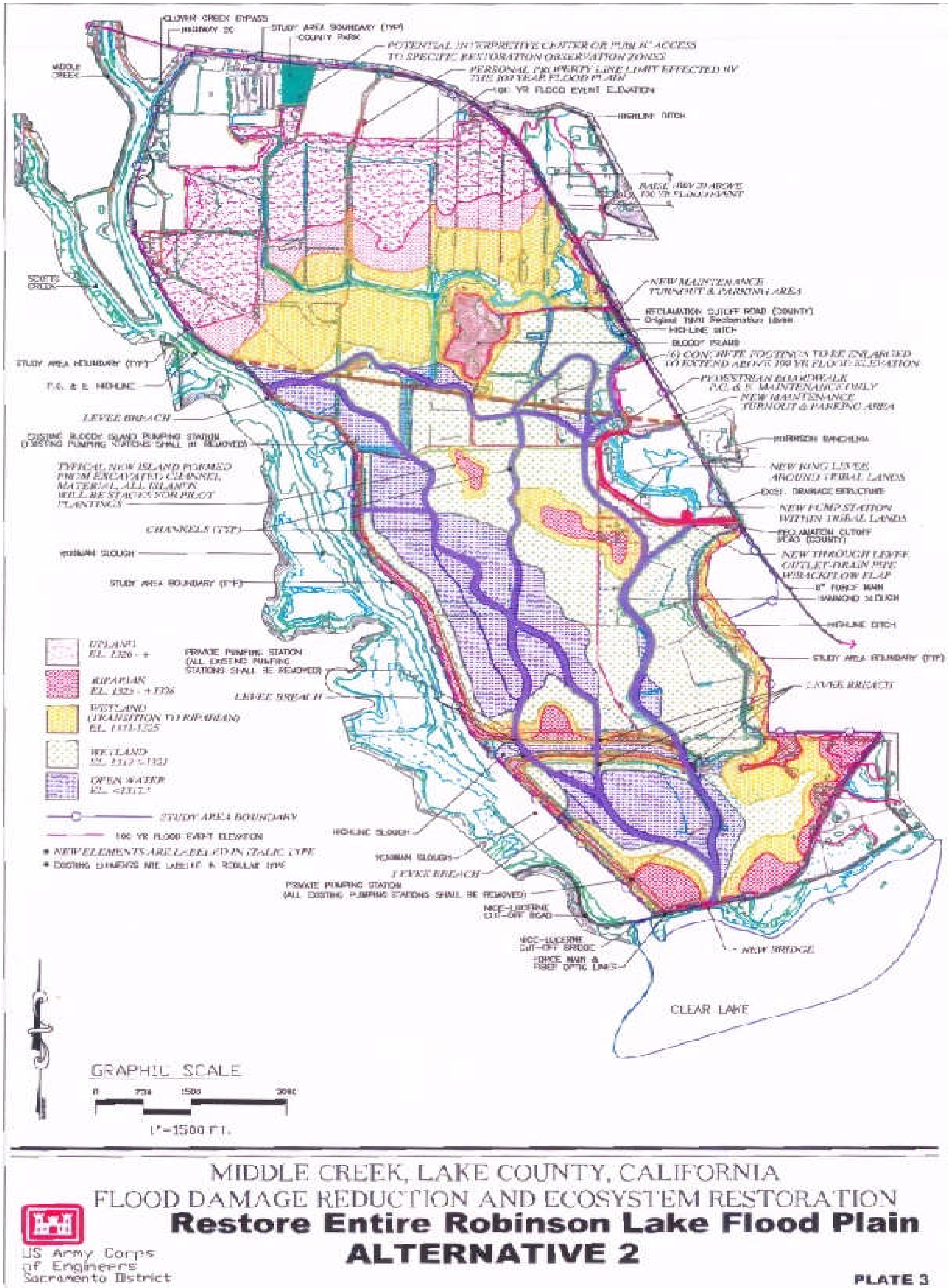

Figure 7-8 Map of proposed Middle Creek Project. Alternative 2 is the project alternative chosen to be pursued in the Feasibility Study/Environmental Impact Report (USACE 2002).

7.8 Debris Jams

Fallen trees and lodging of large woody or man-made debris across a creek can cause serious localized flooding and streambank erosion. Debris jams are more likely to occur in areas where channel size is restricted, such as at bridge crossings. Debris is also more likely to collect, and floods to spread more widely, in areas with a low stream gradient and level floodplains. Some of the areas where this occurs along Scotts Creek include:

- Immediately below Laurel Dell Lake where Highway 20 exacerbates the natural channel constriction.
- The bridge abutment at the Mendenhall property east of Saratoga Springs road.
- Two check dams downstream from this bridge (Figure 7-9).

High streamflows in 2005 created significant debris jams from the Mendenhall property and continuing 1 mile downstream. The West Lake RCD applied for and received FEMA funding to remove approximately 7,400 yd^3 of debris in November 2006 (Figures 7-9, 7-10, 7-11). The debris was removed, chipped, and used for compost at a local vineyard.

Figure 7-9 Debris jam at a flashboard dam prior to removal in 2006. *Photo by Greg Dills.*

Figure 7-10 Clean up of both woody debris and trash during the 2006 FEMA project. *Photo by Greg Dills*

Figure 7-11 One of the debris piles from the project, 2006. *Photo by Greg Dills.*

While landowners may need to remove debris jams to protect their property, flooding and debris jams are also a part of natural stream processes. Shifting stream channels lead to a mosaic of riparian habitats supporting diverse vegetation and wildlife. Large woody debris is important habitat that helps to form natural dams and pools. Where possible, land use patterns should include building set backs and floodplain compatible activities such as agriculture or recreation in order to allow natural stream processes to occur without excessive property damage.

8.0 Water quality

8.1 Stream Water Quality

Physical, chemical, and biological stream characteristics of Scotts Creek and its tributaries are inherently different in the upper and lower portions of the watershed. In the upper watershed streams flow year round, and cool stream temperatures are maintained by groundwater recharge and shaded conditions. Where gradients are significant, rapid streamflow helps maintain lower water temperatures and higher dissolved oxygen levels. Headwater streams are frequently shaded which inhibits photosynthesis of algae and aquatic plants, therefore aquatic life depends on materials such as leaves and twigs from the surrounding vegetation. In general headwater streams have lower concentrations of dissolved chemical compounds than streams below because evaporation causes the chemicals to become more concentrated lower in the watershed (Harrington and Born 2000).

Mid-sized streams receive greater levels of sunlight, allowing greater productivity. They have a more diverse food supply from surrounding vegetation, smaller pre-processed organic particles from upstream, and vegetation (algae and plants) produced in the stream (USDA NRCS 1998). Mid-sized streams frequently have a more gradual stream gradient and variable stream temperatures depending on riparian cover.

Human activities have the potential to alter stream conditions, frequently in ways that harm aquatic ecosystems. Activities such as livestock grazing, construction, road building, and agriculture contribute increased sediment loads to streams. Although suspended sediment can harm fish directly, the greatest harm to aquatic ecosystems comes from deposition of sediment on the stream substrate. Sediment can fill in gravels needed for spawning and smother the habitat needed by insects and other organisms that are the food source for fish (Harrington and Born 2000).

Nutrient sources such as sediment, animal waste, sewage, and fertilizer stimulate algae and plant growth in a process called eutrophication. Eutrophication decreases the diversity of aquatic life because organisms that function as collectors and filterers come to dominate the food web. When the large amount of biomass produced by eutrophication begins to decompose, oxygen levels drop and cause die-offs. Eutrophication also increases turbidity or cloudiness of the water (Harrington, J. and M. Born 2000).

There are numerous toxic pollutants that can enter streams from industrial, agricultural, urban, or municipal wastewater sources. These include metals, such as mercury, lead, or copper; organic compounds, such as petroleum and many pesticides; anions, such as fluoride and cyanide; acids and alkalis that affect the pH of water; and gases, such as chlorine and ammonia (Harringtion, J. and M. Born 2000).

Temperatures are altered by removal of tree canopy or alteration of the streamflow regime. The maximum amount of oxygen that can be dissolved in warm water is lower than that in cold water. Biological activity also speeds up with increasing temperature, therefore oxygen supplies are depleted more rapidly as water temperature increases.

Reduced streamflows due to lower ground water tables and water diversions contribute to the water quality problems discussed above by increasing contaminant concentrations and raising water temperatures.

8.2 Studies on Scotts Creek

The biggest emphasis of water quality studies on Scotts Creek has been on nutrients and sediment because these constituents contribute to impaired water quality in Clear Lake (Section 8.5, Appendix E). Because of nuisance algal blooms caused by excess nutrients, Clear Lake was identified as impaired due to nutrients in 1986 under Section 303(d) of the Federal Clean Water Act. This required the Central Valley Regional Water Quality Control Board (CVRWQCB) to establish a Total Maximum Daily Load (TMDL) program to manage the pollutant and ensure the beneficial uses of Clear Lake (CVRWQCB 2006). Clear Lake is also on the federal 303(d) list for mercury, and the TMDL for Control of Mercury in Clear Lake was approved in December 2002. Sediment is considered to be the primary source of excess nutrients in Clear Lake. The Sulphur Bank Mercury Mine is considered to be the major source of mercury entering Clear Lake, however, some mercury comes from the surrounding watershed, primarily in sediment bound form.

Water quality samples are taken near the permanent stream gages to determine a relationship between streamflow rate and the amount of sediment or nutrients suspended in the water. Because of the great variability of rainfall patterns in California, it is necessary to continue these studies over many years (Florsheim J. 2007). The studies are also continued in order to find out whether nutrient and sediment transport is changing due to changing land management practices.

Figure 8-1 Streamflow carrying sediment into Upper Blue Lake. *Photo by Greg Dills.*

As part of a UC Davis study, water was sampled during the winters of 1991-1992 and 1992-1993 at the DWR gages on Kelsey, Scotts, and Middle Creeks. Although the number of samples in this study was small (7, 6 and 6 for Kelsey, Middle and Scotts Creeks, respectively) the information was used to estimate phosphorous and sediment inputs to Clear Lake (Richerson et al. 1994). The Lake County Public Works Department (LCPWD) carried out further sampling on Kelsey, Scotts, and Middle Creeks from 1992-1998. Parameters measured were temperature, pH, conductivity, total solids, dissolved solids, orthophosphate, and total phosphorus. In 2007-2008, additional sampling was carried out. The 2007-2008 total suspended solids and total phosphorus data for Scotts Creek are shown below in Figures 8-2 and 8-3. In all cases, the sampling studies found that the concentrations of sediment and phosphorus increased as streamflows increased.

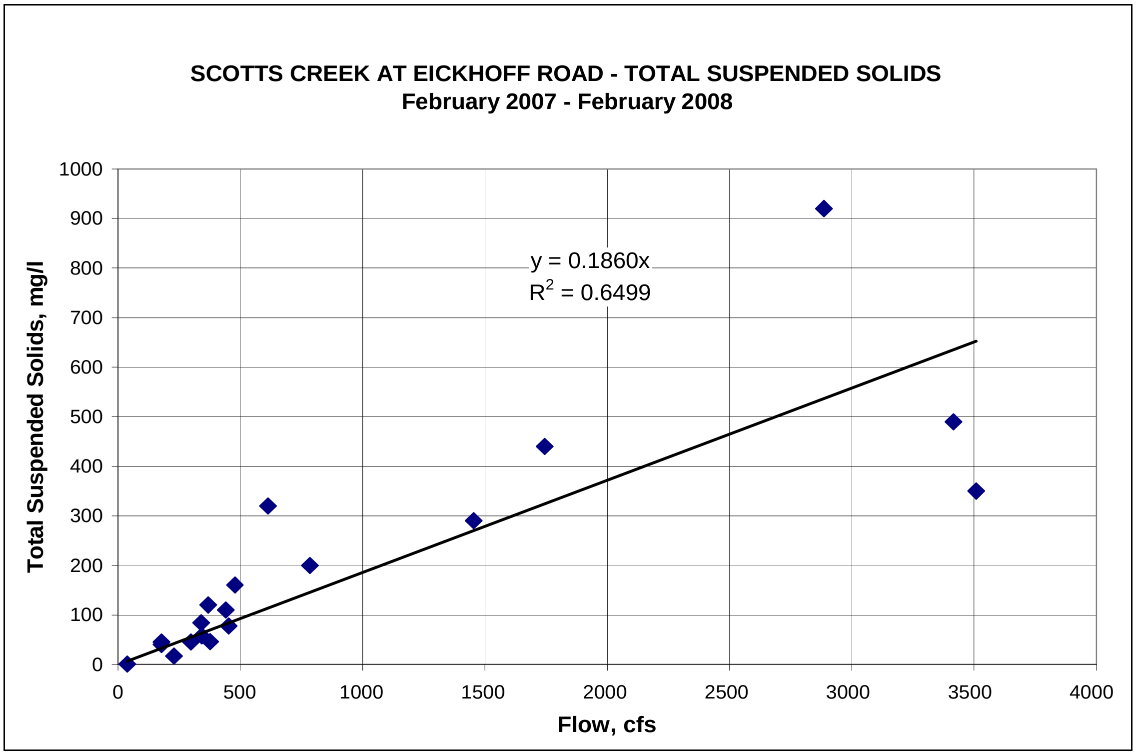

Figure 8-2 Relationship between sediment and streamflow in Scotts Creek.

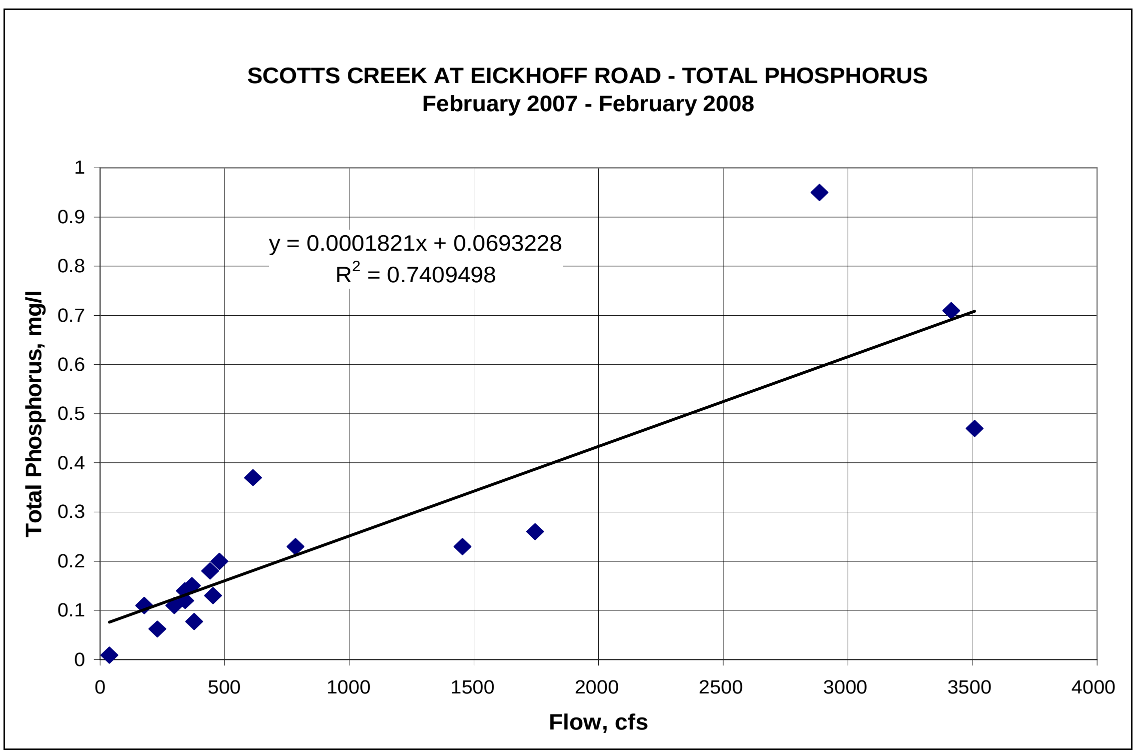

Figure 8-3 Relationship between total phosphorus and streamflow in Scotts Creek.

Stream water quality data from DWR is limited to one location, west of Saratoga Springs Rd. on two sample dates October 1964 and March 1965, and so is insufficient to characterize stream chemical and physical characteristics.

Local volunteer water quality monitoring teams, "stream teams" monitored stream health with stream bioassessments made from 2004-2006. Using relatively simple physical and chemical measurements, as well as a biological component, their objective was to gage the ecological health of local stream systems. The advantage to this approach is that "biological and physical assessments are substantially less expensive than chemical and toxicological testing, integrate the effects of water quality over time, are sensitive to multiple aspects of water and habitat quality, and provide the public with more familiar expressions of ecological health" (SLSII 1999). With grant funding from the 319h federal non-point source pollution program, local watershed groups provided training workshops and guidance for the volunteers.

The volunteer groups measured streamflow, temperature, dissolved oxygen, pH, conductivity, and turbidity. They sampled and identified benthic macroinvertebrates[5] and made visual observations of stream conditions using the California Stream Bioassessment Procedure in Scotts Creek on June 17, 2006. The monitoring was conducted about 3,900 feet upstream of the Blue Lakes outlet. Bioassessment results gave this location in Scotts Creek a rating of poor based on a Russian River watershed index, and complete results for the sample are in Appendix F.

Pesticide monitoring on creeks in Lake County has been carried out since 2005 to comply with the state Irrigated Lands Regulatory Program. Most owners of irrigated agricultural lands in Lake County have joined the Sacramento Valley Water Quality Coalition (SVWQC), which is managing the monitoring program. Monitoring was initiated in the area with the heaviest concentration of agriculture, Big Valley, and after two years it was shifted to Middle Creek. While monitoring has not been done on Scotts Creek, the results for Big Valley and Middle Creek are discussed here because they are agricultural areas in Lake County that are similar to Scotts Valley.

Tests were made for numerous chemical constituents, including 70 types of pesticides. The tests were carried out on 2-3 samples each year. These tests found two exceedances of regulatory limits. In McGaugh Slough in Big Valley *E. coli*, a bacterium indicating possible fecal contamination, was found to exceed regulatory limits, However the source of *E. coli*, whether from livestock, birds and wildlife, or humans, was not determined (SVWQC 2006).

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[5] The benthic zone is the substrate below a body of water. Benthic macroinvertebrates are "animals without backbones that are larger than ½ millimeter (the size of a pencil dot)." They include "crustaceans such as crayfish, mollusks such as clams and snails, aquatic worms, and the immature forms of aquatic insects such as stonefly and mayfly nymphs" (MDNR 2004).

In Middle Creek DDT was found in one sample (SVWQC 2007). DDT is a "legacy" pesticide that has been banned for use in the United States since 1972. It is very persistent and binds to soil. Therefore its detection may have been due to soil disturbance.

In addition to testing for pesticides, toxicity tests on 3 types of aquatic organisms were made on each sample date. On one sample from McGaugh Slough, toxicity for *Daphnia* (a tiny crustacean) was detected, however no pesticides likely to have caused this toxicity were detected. The only pesticide detected in addition to DDT was the herbicide simazine, which was detected twice in McGaugh Slough and once in Middle Creek at levels below water quality regulatory thresholds (SVWQC 2006).

Although not specifically measuring water quality, an analysis of South Cow Mountain trails identified trails with a high potential to contribute to sedimentation (LCFCWCD 1997). It is not clear how this analysis was tied to subsequent actions by the BLM for trail improvement and decommissioning.

Illegal marijuana gardens may also cause water pollution with fertilizer, diesel, and other chemicals (Section 15.2).

8.3 Groundwater Quality

Groundwater quality depends on the quality of water that recharges the aquifers, the chemical properties of the aquifer matrix, and natural or human inputs such as fertilizer and pesticides, septic system leachate, or waste disposal area leachate.

Improperly designed septic systems have the potential to affect groundwater quality when septic system leachate percolates to groundwater. A 1990 study of septic systems around Blue Lakes found fecal coliform levels that exceeded drinking water standards in the upper portions of some aquifer areas and increased nitrate levels in upper groundwater zones. The study attributed problems to small lot sizes with limited suitable land area for septic systems, insufficient setback from local drainages and domestic water wells, coarse, excessively drained alluvial soils, and a 23% rate of properties with septic system problems. None of the septic systems that were inspected were in full conformance with Lake County septic system codes (Questa Engineering Corporation 1990). The findings of the above studies did not indicate problems severe enough to qualify for state funding in the 1990s, and no follow up was made to improve these areas (Ray Ruminski, personal communication).

DWR samples well water periodically for a range of minerals, nutrients and physical measurements such as electrical conductivity. A summary of the available DWR groundwater data from the Scotts Valley groundwater basin from 1949-2000 is given in Table 8-1. When measured levels exceeded primary or secondary drinking water or agricultural standards, the number and range of exceedances is reported. The total number of samples that were taken is also reported.

Primary drinking water standards are legally enforceable standards to protect public health. They apply to public water systems. Secondary drinking water standards are nonenforceable guidelines that regulate contaminants that may cause aesthetic or cosmetic affects (USEPA 2009). Both California and the federal government establish drinking water standards, and California standards are sometimes more stringent than the federal standards. The agricultural standards are based on a report by the United Nations Food and Agriculture Organization (Ayers 1985) as quoted in the CVRWQCB Water Quality Goals (CVRWQCB 2008).

Based on the available DWR data, there were one exceedance of primary drinking water standards, no secondary drinking water exceedances, and three agricultural quality water exceedances measured in the Scotts Valley groundwater basin (Table 8-1). The primary drinking water standard for lead was exceeded, however it is not clear whether lead is a significant problem in the Scotts Valley groundwater basin because there were only 5 samples in which lead was measured from 1949-2000. There were also very few samples of other potentially harmful elements such as mercury and arsenic. Prospective buyers and landowners are advised to test well water because data on water quality for the area are limited.

DWR measurements of nitrogen-containing compounds such as ammonia, ammonium, nitrate and nitrite are not reported in Table 8-1 because DWR reporting of the units of measurement (as nitrogen or the entire compound) was not consistent or clear over the 1949-2000 time period.

Table 8-1 Scotts Valley groundwater basin chemistry, electrical conductivity, and pH, measured by DWR from 1949-2000.

Constituent	Average (Concentration in mg/L unless noted)	Number of Samples	Number of Exceedances	Range of Exceedance Concentrations (mg/L unless noted)	Exceedance type and limit
Alkalinity	139.67	45			
Aluminum	0.0220	1			
Arsenic	0.0022	5			
Barium	0.0900	3			
Boron	0.19	39	1	0.7	Agriculture, 0.70 mg/L
Cadmium	0.0008	4			
Calcium (dissolved)	31.28	43			
Chloride	6.78	51	1	108	Agriculture, 106 mg/L
Chromium	0.0063	4			
Copper	0.0052	5			
Electrical Conductivity (field)	301.08 micromhos	13			
Fluoride	0.18	12			
Iron	0.0347	6			
Lead	0.0070	5	1	0.0190	Primary Drinking Water Standard, 0.015 mg/L
Magnesium	14.51	43			
Manganese	0.0064	5			
Mercury	0.0003	3			
Nickel	0.0010	1			
pH (field)	7.11 pH units	13			
Potassium	0.85	42			
Selenium	0.0013	4			
Silicon Dioxide	14.55	11			
Sodium	12.41	50	1	91	Agriculture, 69 mg/L
Sulfate	7.13	8			
Total Dissolved Solids	158.65	23			
Turbidity	0.30 NTU	1			
Zinc	0.1326	5			

8.4 Blue Lakes Water Quality

There is very little information on water quality in Blue Lakes. The Upper Blue Lake is 45-55 feet deep (DFG 1976). The depth of the lower lake, Laurel Dell Lake is not documented. In most winters, Scotts Creek backs up into Laurel Dell Lake, undoubtedly contributing sediment and nutrients to the lake. Laurel Dell Lake may be shallower than Upper Blue Lake and this in combination with the increased nutrient load may cause the reduced water clarity in Laurel Dell lake.

A 1990 study found fecal coliform levels in surface waters of both Blue Lakes to be elevated above background levels. On average the levels were lower than the standard for contact recreation, however there were several exceedances of the limit for contact recreation waters (Questa Engineering Corporation 1990).

8.5 Clear Lake Water Quality

As the largest tributary to Clear Lake, Scotts Creek has an important impact on Clear Lake water quality. Clear Lake has been identified as having impaired water quality due to nutrients and mercury under Section 303(d) of the Federal Clean Water Act. High nutrient levels in Clear Lake have led to nuisance blue green algal blooms, and the primary source of the nutrients was determined to be sediment loads to the lake. Clear Lake fish contain high levels of mercury which prompted the California Department of Health Services to issue a 1987 advisory recommending limited consumption of Clear Lake fish. Approximately 97% of the mercury contamination in Clear Lake comes from the Sulphur Bank Mine, located on the Oaks Arm of Clear Lake, however mercury also enters the lake from naturally mercury-enriched soils (CVRWQCB 2002).

The Lake County Watershed Protection District (LCWPD) carried out watershed sampling to detect potential mercury hotspots from 2006-2008. Samples taken in the Scotts Creek Watershed outside of BLM land showed no elevated mercury levels. A previous USGS study found a location with moderately elevated mercury levels near Eight Mile Valley on BLM land. BLM has not taken follow up samples in this area. However, samples taken by the LCWPD found that total mercury levels downstream of Eight Mile Valley at the confluence of Scotts Creek and the South Fork of Scotts Creek were well below the background level (LCWPD 2009).

A detailed description of historic and current Clear Lake water quality conditions is given in Appendix E.

9.0 Water supply

The major surface water supplies in the Scotts Creek Watershed are Scotts Creek and Blue Lakes. The only groundwater supply in the watershed that has been studied is the Scotts Valley aquifer. Total groundwater storage in the Scotts Valley aquifer is estimated to be about 5,900 acre-feet, and usable storage is estimated to be 4,500 acre feet (Wahler W.A. & Associates 1970).

Water use in the Scotts Creek Watershed was determined as part of the Lake County Water Inventory and Analysis (LCWIA), which used the year 2000 to represent a year with average precipitation (CDM and DWR 2006b). Agricultural water use accounted for 89% of the total water use in the watershed. Municipal and industrial use including residential, commercial, industrial and institutional water use, accounted for only 10% (Table 9-1). Conveyance losses were less than 1% of total water use.

Table 9-1 Estimated water use in the Scotts Valley watershed for the year 2000.

Water User	Total Water Use (acre-feet)[a]	Adjusted Total Water Use (acre feet)[b]
Municipal & Industrial	120	890
Agricultural	6,929	7,667
Conveyance losses	212	212
Total	7,261	8,579

[a] Lake County Water Inventory and Analysis Final (CDM and DWR 2006b).
[b] Adjustments to more accurately reflect water use include the following: Because water use for frost protection was not included, water use for pears and grapes was increased by 39% based on Christensen Associates, Inc. 2003. Water use for City of Lakeport wells located in Scotts Valley was not included in the LCWIA, so they have been added to the M&I category.

The LCWIA estimated that about 60% of total water use came from groundwater, and 40% from surface water (Table 9-2). Of the total groundwater use of 4,373 acre-feet per year, an estimated 2,370 acre-feet came from the Scotts Valley aquifer, and the remaining 2,000 acre-feet came from other areas. According to the study, no surface water was used for agriculture in Scotts Valley. A substantial amount of surface water is used for wild rice production in Tule Lake and to the east adjacent to Highway 29.

Table 9-2 Sources for water use in the Scotts Creek Watershed in 2000.

Water source	Total Use (acre-feet)	% of Total
Surface water	2,888	39.7
Groundwater	4,373	60.3
Total	7,261	

Recent trends in agricultural crops are likely to have reduced total water use. Lake County pear acreage has declined continuously since its peak in 1980, and it has continued to decline sharply in recent years. For example, acreage decreased 47% from 2000 to 2007 (LCDA various). Scotts Valley has seen a decline similar to the county trend. In some cases, pears have been replaced by irrigated walnuts, pasture, or vegetable crops. However, in many cases, pears were replaced by fallow land or un-irrigated pasture. There are only 12 acres of wine grapes in Scotts Valley, and the countywide increase in vineyard acreage has stopped in recent years due to poor market conditions for wine grapes.

Well levels measured by the Lake County DPW show evidence for reduced agricultural water use in Scotts Valley. Fall water levels in 2005-2007 were higher than in much of the preceding decade even though spring rainfall in 2007 and 2008 was very low (Figure 7-3). Additional years of monitoring are needed confirm this trend. The last completed survey of agricultural land use by the DWR was in 2001. DWR surveyed again in 2006, however they have not completed their analysis. The results of this survey will be an important tool for estimating changes in agricultural water use.

Along with the water inventory and analysis, a water demand forecast was developed for Lake County (CDM and DWR 2006a). Because the population is forecast to increase 62% by 2040, residential water use was forecast to increase by the same amount. In order to give a range of possible long term agricultural water requirements, three scenarios for future agricultural water demand were developed (Table 9-3). All three include removal of substantial acreages of pears and walnuts and a large increase in the area of vineyards. Because vineyards require 50% or less irrigation water than do pear orchards, Scenarios 1 and 2 show a decline in water use. Scenario 3 assumes replacement of pear and walnut acreage with crops with a similar water demand. Complete details for the three scenarios are given in Appendix G. The three scenarios estimate a maximum increase in water use of 12% on average years and 14% on dry years. Again frost protection water is not included in the projected water demand estimates.

Table 9-3 Current (2000) and projected (2040) water demand for the Scotts Valley watershed under three different cropping scenarios.

	Irrigated Cropland (acres)	**Average Year Applied Water (acre-feet)**
Current (2000)	2,205	6,929
2040		
Scenario 1	1,465	4,931
Scenario 2	1,648	5,394
Scenario 3	2,355	7,351

A multipurpose reservoir to provide flood control, water supply for the City of Lakeport, groundwater recharge, and recreation was proposed on Scotts Creek above Scotts Valley (USACE 1965, 1972), however a 1984 feasibility study found that the project was not cost effective (USDA SCS 1984).

10.0 Terrestrial Wildlife Habitats and Species

10.1 Natural Habitats

Wetlands are very productive wildlife habitats providing food, cover, and water for more than 160 bird species, and many mammals, reptiles, and amphibians (DFG 1988). They are characterized by rooted, erect aquatic plants such as common cattail and tule bulrush. There is a currently a small area of wetland within the Scotts Creek Watershed near the mouth of Scotts Creek (Plate 12). In addition Tule Lake was a seasonal lake and wetland prior to its being reclaimed for agriculture, and it still provides a stopover for waterfowl and water birds and a wintering area for bald eagles. The DFG and USACE have proposed wetland restoration and wildlife areas at Tule Lake and the adjacent Rodman Slough Reclamation Area that would restore large areas of wetlands and provide valuable wildlife and fish habitat (Section 17.6).

Riparian habitats are relatively narrow strips of land bordering streams, rivers, and other water bodies. The vegetation in riparian areas differs from the surrounding landscape because it requires or tolerates wet and sometimes flooded conditions. Although riparian habitat makes up a small proportion of the total land area, it is important habitat for a wide variety of animals. Of all California animal species, an estimated 25% of land mammals, 40% of reptiles, and 83% of amphibians depend on riparian habitats for some or all of their life cycle (Brode, J.M. and R.B. Bury 1984, Williams, D.F. and K.S. Kilburn 1984). Riparian habitats are considered the most critical habitat for conservation of resident and Neotropical migrant birds in the western U.S. Riparian vegetation provides shade, food, and nutrients that are the basis of the aquatic food chain. Despite the importance of riparian habitat, it is estimated that only 2-15% of historic riparian habitat remains in California (CalPIF 2004).

Riparian habitats follow Scotts Creek and its tributaries throughout the watershed, however they are not shown on the vegetation map because their extent is smaller than the area of the vegetation map units, which are 100m X 100m. The lowest portion of riparian habitat in the Scotts Creek Watershed is characterized by an over-story of cottonwood, willow and ash (Nielson and McQuaid 1981). In valley areas with deep soils and good water availability riparian habitats in their natural state have complex, multi-layered tree and shrub canopies that are important to a wide array of wildlife. The natural meandering of streams in nearly level valleys promotes a mosaic of riparian vegetation stages.

A survey of riparian zones downstream of the confluence of Scotts Creek with its South Fork (18.2 miles surveyed) as well as 3 miles of Hendricks Creek was carried out in 1985 for the ARMP (Lake County Planning Department 1992). The surveys included detailed descriptions of channel conditions, adjacent land use and riparian plant communities. No surveys of channel conditions and riparian habitat have been carried out since that time in the lower watershed. A survey of riparian habitats on BLM lands in 1999 found that all riparian habitats in the Cow Mountain area were in proper functioning condition (USDI BLM 2006).

At middle elevations typical riparian over-story includes willow, ash, alder and oak. In the upper Scotts Creek Watershed Ash is replaced by Alder above the confluence with Lyons Valley Creek. Above this point, Scotts Creek flows through a narrower, steeper canyon fed by shorter side canyons (Jared Hendricks Jr., personal communication). A 1959 DFG stream channel survey described oaks and other hardwoods lining the banks of Scotts Creek from the headwaters to the confluence with the South Fork, while a 1997 DFG stream channel survey from Willow Creek to the confluence found that “Vegetative cover adjacent to the stream consisted mainly of clusters of willow and alder, with extensive stands of sedges that concealed the stream channel in many of the more open areas” (DFG 1959a and 1997a). Because the descriptions of vegetation are very general and the standards for describing vegetation adjacent to the stream channel may have changed from 1959 to 1997, it is not clear whether these two surveys describe a real reduction in stream channel tree cover. Willow and Lyons Valley Creeks typically have canopies of live oak from adjacent north facing slopes and willow, and approximately one-half of the streams have no tree canopy (Jared Hendricks Jr., personal communication).

Oak woodlands Along with reclaimed wetlands the broad, level agricultural valleys in the lower portions of the Scotts Creek Watershed have been most heavily modified from their natural condition. Agricultural fields and orchards in these areas were once dominated by valley oak woodlands. These oaks provide nesting sites for cavity nesting birds and acorns that are an important food source for many animals and birds. Today valley oaks are found lining many of the roads in Scotts and Bachelor Valleys and in scattered areas throughout the lower watershed.

Blue oak woodlands are the predominant hardwoods on south and west facing slopes at lower elevations. Blue oaks thrive in hot, foothill areas with shallow soils. Their under-story generally contains an array of introduced grasses and forbs which have replaced native perennial bunch grasses (CalPIF 2000, DFG 1988). Blue oak groves are found scattered throughout the large extent of the Scotts Creek Watershed that is dominated by chaparral, and they are found on south facing slopes in Bachelor Valley. Like valley oaks, the acorns from blue oaks provide a vital resource to wildlife including birds, small mammals and deer.

Statewide, both valley and blue oaks have been identified as showing locally poor to moderate regeneration resulting in concern for their future viability as a forest type. Young, first year seedlings and old trees are present, but a combination of competition from introduced grasses, fire suppression, and herbivory appears to reduce seedling survival (CalPIF 2002b). On BLM Cow Mountain lands, poor native oak regeneration has been noted (USDI BLM 2006). In some areas of the upper watershed seedling survival of blue oaks is uneven with some areas supporting numerous young trees, and other areas no young trees (Jared Hendricks Jr. personal communication).

Montane hardwoods are found on north facing slopes in the upper watershed. Dominant trees include interior live oak, canyon live oak, California bay laurel, madrone, black oak and Douglas fir. In the Scotts Creek Watershed, a large forest of black oaks covers the top and north sides of Big Cow Mountain. This forest may be one of the biggest and most pristine examples of black oak forest in the state with trees reaching 35-45 feet in height (Jared Hendricks Jr., personal communication). As always acorns provide a vital food source to birds and wildlife. Many amphibians and reptiles are found on the forest floor (DFG 1988).

The types of oaks found in the upper watershed have not been found to have problems with regeneration, but some of them are susceptible to sudden oak death (SOD), caused by the agent, *Phytophthora ramorum*. This pathogen infects a wide range of plant species (including bay laurel, manzanita, Douglas fir, rhododendrons, and buckeye), but causes mortality in only a few (including tanoak, California black oak and coast live oak). SOD has not been found in the Scotts Creek Watershed, and the risk of SOD spread may be low because the watershed is inland from the coastal fog belt where SOD is prevalent. Nevertheless, watershed residents and visitors should avoid introducing potentially contaminated plant material or soil attached to vehicle tires and shoes from infected areas (COMTF 2004). Lake and other counties where SOD has been found are under state and federal quarantines regulating transportation of wood products and nursery plants that host SOD.

Grasslands are scattered throughout the Scotts Creek Watershed with the greatest concentration found around Bachelor Valley. Beginning with the first Spanish colonists in California, livestock grazing led to replacement of native perennial bunch grasses with non-native annual grasses in about 100 years. Most of California's original grasslands have been converted to agriculture, and today the majority of California grasslands occur in areas that were cleared by ranchers from shrub and oak woodlands (CalPIF 2000, DFG 1988). In most of California grasslands (and in other habitats with a grass understory), common annual grasses include wild oats, soft chess, ripgut brome, red brome, wild barley, and foxtail fescue. Common forbs include filarees, turkey mullein, clovers, and popcorn flower.

Stands of native perennial grasses are found in Eight Mile Valley in the BLM Cow Mountain Recreation Area. BLM has an on-going project to expand and restore the native grassland in Eight Mile Valley. Working with volunteer groups to collect seed, and Circuit Rider Productions, Inc., a non-profit watershed restoration group to propagate the plants, the BLM carried out two plantings of native bunch grasses in 2003 and 2005. This work has led to restoration of approximately 4 acres in the "deer exclosure" area.

Chaparral is brushy habitat that occurs on dry, shallow soils of hill- and mountainsides. Chaparral plants are adapted to fire; some have seeds that germinate following fire and roots that re-sprout following fire. Many chaparral plants have evergreen leaves covered with a heavy waxy cuticle to prevent water loss. Dominant plants in chaparral include scrub oak, chaparral oak, chamise, and several species of manzanita and ceanothus. In mature stands of chaparral, vegetative cover is often greater than 80%. On very rocky soils, or soils formed on ultramafic minerals, cover may reach only 30% (DFG 1988). On north- and east-facing slopes plant species change due to reduced sunlight and water stress. Dominant species can be scrubby Live Oak and Canyon Oak, Mahogany, Ceanothus, Madrone, Bay and sometimes Black Oak (DFG 1988, Nielson and McQuaid 1981).

Chaparral plant communities change following wildfire. For 1-3 years after a fire, herbaceous cover dominates, while re-sprouted shrubs increase in size. Brush canopy begins to dominate from 3 to 15 years following the fire. From 10 to 30 or more years after a fire, the canopy closes together and dead plant material accumulates (DFG 1988). A major focus of vegetation management in the BLM Cow Mountain area is prescribed burning of chaparral areas to improve wildlife habitat and to prevent wildfires spreading to adjacent lands. Prescribed burning provides a mosaic of stages in chaparral growth with greater food availability and structurally diverse habitats.

Research on chaparral recovery and plant diversity following either prescribed burning or brush mastication treatments was recently carried out in an area just to the west of the Scotts Creek Watershed. Chamise recovered more rapidly following prescribed fire, than following mastication. Non-native plants, especially grasses, were more abundant following mastication than following fire (Stephens et al. 2006).

Conifers Islands of knobcone pine and McNab cypress are found within surrounding areas of chaparral. These conifers rely on fire for their seeds to germinate, and the full sunlight present following a wildfire promotes seedling establishment and dense, even-aged stands of these trees.

There are small areas dominated by Douglas Fir to the west of Eight Mile Valley. These trees are present in cooler, wetter locations on north and east facing slopes. Small stands of Douglas fir also occur along upper Scotts Creek on north-facing slopes (Figure 10-1). The conifers mapped to the north of Bachelor Valley are primarily Douglas fir in a mixed hardwood-conifer forest (Plate 12).

Figure 10-1 Douglas fir stands along Scotts Creek in the upper watershed. *Photo by Jared Hendricks, Jr.*

For a photographic overview of the watershed from the headwaters to base of Scotts Creek, see Appendix H.

A list of the plant and animal species in the Cow Mountain area was compiled for the 1984 BLM Cow Mountain Wildlife Habitat Management plan and is included in Appendix I. This list is limited to BLM lands and may not include species that occur at lower elevations.

10.2 Wildlife

The California Wildlife Habitat Relationships (CWHR) System (Version 8.1, 2005) was used to determine potential terrestrial vertebrate species present in the Scotts Creek Watershed. This database allows the user to input the habitats found in the watershed to determine what species are potentially present. It generated a list of 14 amphibian, 17 reptile, 224 bird, and 65 animal species that may be present in the Scotts Creek Watershed during all, or some part, of the year (Appendix J). The CWHR System apparently selects by habitat, and not by known geographic range of animals, and therefore it may include animals not found in the area. The CWHR System also reports the conservation status of the animals.

A large proportion of wild lands in the Scotts Creek Watershed are managed by the BLM as part of the Cow Mountain unit. BLM manages migratory bird habitat by restoring and enhancing riparian and native oak habitats, by avoiding adverse impacts on migratory bird habitat during project work, and by long term monitoring of bird populations and their habitats (USDI BLM 2006).

The BLM cooperated in a recent study with UC Berkeley researchers to investigate the effects of either prescribed fire or brush mastication on vegetation, bird communities, and fuel load reduction. Researchers found that there were more bird species and over eight times as many birds in prescribed fire areas compared to masticated areas. They attributed much of this difference to the plant skeletons that are present after fire which provide perching and nesting sites, protection from predators, food sources (insects), and greater variations in microclimate. Results from this study are still being compiled and additional information on the effects of deer browsing on vegetation recovery and detailed results of plant and bird responses are still to be published (Stephens et al. 2006).

The BLM manages for game species consistent with DFG regulations. Game species on Cow Mountain include the black-tailed deer, black bear, wild pig, western gray squirrel, wild turkey, mourning dove, and California quail. Land management for game species is primarily for the black-tailed deer. The BLM reports lower deer numbers throughout the state for the past 40 to 50 years, and cites the following reasons: "predation, highway mortality, poaching , disease, and a continuing decrease of suitable habitat, the latter being the most likely significant reason" (USDI BLM 2006). The BLM also discusses the importance of prescribed burning in chaparral to create a succession of chaparral communities and good forage for deer. The BLM Resource Management Plan (2006) mentions that prescribed burning has been used for over 25 years, however this has not always been the case. The BLM 1984 Cow Mountain Wildlife Habitat Management Plan (BLM 1984) describes several management activities to improve habitat for deer and other wildlife. Prescribed burning on south facing slopes to give a mosaic pattern of vegetation stages is a major focus because it opens up cleared areas giving deer access to tender sprouting vegetation. This younger vegetation is more protein rich, and has been demonstrated to improve the condition of deer including the amount of body fat, luster of coat and size of legal bucks. Other management actions include protection of wet meadows and glades (such as Eight Mile Valley) from damage by OHV traffic, and improving springs and other water resources for wildlife.

An interesting perspective on changing attitudes toward prescribed or controlled burning was given in a 1968 paper by Jared Hendricks Sr. and is summarized here. Prior to the 1930s the chaparral deer range on the North Coast was burned regularly by local ranchers and sportsmen. In the late 1930s and early 1940s the California Department of Forestry established regulations prohibiting this kind of burning. By the 1950s deer were starving as older "decadent" chaparral reached a height where most new shoots were above the reach of deer. Deer herds also began to migrate down to valley floors, invading orchards and fields. The DFG wanted a doe and fawn shoot to deal with this problem, however local ranchers and sportsmen felt that these animals would be needed to restock the hills when their natural habitat could be improved. In 1955 they formed the Scotts Valley Deer Fence Association and assessed themselves to construct a 7 mile deer fence and do prescribed burning. By1963 they had burned a total of 4,000 acres on private and public lands and found that the deer returned to the hills, deer numbers increased, and the deer were in better condition than when they were in the croplands. Other changes following prescribed burning included increased stream and spring flows and improved grass growth. In 1967 when the ranchers wanted to resume prescribed burning, new bureaucratic road blocks prevented additional burning.

Some landowners continue to use prescribed burning to reduce the threat of large wildfires and improve wildlife habitat. Jared Hendricks Jr. uses prescribed burning to increase deer forage availability and streamflows. He has found that many blue oak groves were fire scarred by the severe wildfire of 1981. Fall prescribed burning has the potential to re-ignite the dead wood on these trees and kill them. Therefore, he uses spring prescribed burns to clear areas near the groves and protect this important food resource. He tries to encourage three important habitat components for deer, new growth on recently burned chaparral, the fall acorn crop, and both of these in proximity to water (Figures 10-2, 10-3).

Figure 10-2 Fire scarred blue oak trunk, Scotts Creek Watershed. *Photo courtesy of Jared Hendricks, Jr.*

Figure 10-3 Prescribed burn areas adjacent to blue oak woodlands, Scotts Creek Watershed. *Photo courtesy of Jared Hendricks, Jr.*

Following the low annual average flows (Figure 6-4) and exceptionally dry spring conditions of 2007 and 2008, summer flows have ceased in large portions of Scotts Creek where they usually flow the entire year. In addition, springs that usually flow year round are going dry. These conditions impose a water shortage for both terrestrial and aquatic wildlife. Mr. Hendricks has developed a proposal for a wildlife habitat restoration and enhancement project in the upper Scotts Creek Watershed. This project would use teams of college age students to inventory and improve access to wildlife summer water sources, monitor summer streamflows and water quality, and carry out watershed improvement projects such as clean up of old camps. Working with the West Lake RCD, Mr. Hendricks will submit this proposal to several funding agencies.

10.3 Sensitive Species

The CWHR system identifies species status, and it identified 64 threatened, endangered, protected, or sensitive animal species that could potentially be found in the Scotts Creek Watershed (H). Another program, the California Natural Diversity Database (CNDDB) provides information on the location and status of rare and endangered plants, animals, and natural communities when they have been discovered and reported to the CNDDB. In the Scotts Creek Watershed only rare plants have been observed and reported to the CNDDB (Table 10-1). A list of CNDDB sensitive species found in the entire county is given in Appendix K (CNDDB 2008).

Table 10-1 CNDDB rare, threatened and endangered species in the Scotts Creek Watershed.

Common Name	Scientific Name	Federal Status[1]	California Status[2]	CNPS Rank[3]
Plants				
Sonoma manzanita	*Arctostaphylos canescens ssp. sonomensis*	none	none	1B.2
Raiche's manzanita	*Arctostaphylos stanfordiana ssp. raichei*	none	none	1B.1
bristly sedge	*Carex comosa*	none	none	2.1
serpentine cryptantha	*Cryptantha clevelandii var. dissita*	none	none	1B.1
Norris's beard-moss	*Didymodon norrisii*	none	none	2.2
glandular western flax	*Hesperolinon adenophyllum*	none	none	1B.2
Colusa layia	*Layia septentrionalis*	none	none	1B.2
beaked tracyina	*Tracyina rostrata*	none	none	1B.2
Northern Interior Cypress Forest		none	none	
Serpentine Bunchgrass		none	none	

[1] Federal species status
[2] State of California species status
[3] California Native Plant Society Ranking. 1A presumed extinct in California (CA), 1B rare, threatened, or endangered in CA or elsewhere, 2 rare, threatened, endangered in CA, more common elsewhere, 3 status uncertain, 4 limited distribution, 0.1 seriously threatened in CA, 0.2 fairly threatened in CA, 0.3 not very threatened in CA.

The BLM has identified 17 special status wildlife species on Cow Mountain lands (Table 10-2). The BLM monitors threatened and endangered species and their habitats to contribute to species recovery (USDI BLM 2006).

Table 10-2 Sensitive status species and their habitat preferences found on BLM Cow Mountain land.

Species/Status	**Preferred Habitat**
Desmocerus californicus dimorphus **Valley Elderberry Longhorn Beetle** Federal: Threatened	Central Valley. Requires elderberry shrubs for breeding. Occurs only in the central valley of California, in association with blue elderberry (*Sambucus mexicana*). Prefers to lay eggs in elderberries 2-8 inches in diameter; some preference shown for "stressed" elderberries.
Rana boylii **Foothill Yellow-legged Frog** Federal: Species of Concern State: Species of Special Concern BLM: Sensitive	Breeding occurs in the spring, where adults congregate in habitats consisting of shallow, slow flowing water with pebble and cobble substrate, preferably with shaded riffles and pools (Fuller and Lind 1992). This species is also known to utilize moderately-vegetated backwaters, isolated pools, and slow moving rivers with mud substrates.
Emys (=Clemmys) marmorata **Western Pond Turtle** State: Species of Special Concern	A thoroughly aquatic turtle of ponds, marshes, rivers, Streams, and irrigation ditches with aquatic vegetation. Need basking sites and suitable (sandy banks or grassy open fields) upland habitat for egg-laying.
Lampropeltis zonata zonata **St. Helena Mountain Kingsnake** BLM: Sensitive	Variety of habitats including valley-foothill hardwood, coniferous, chaparral, riparian, and wet meadows.
Accipiter cooperii **Cooper's Hawk** State: Species of Special Concern	(Nesting) woodland, chiefly of open, interrupted or marginal type. Nest sites mainly in riparian growths of deciduous trees, as in canyon bottoms on river flood-plains; also, live oaks.
Accipiter striatus **Sharp-shinned Hawk** State: Species of Special Concern	(Nesting) riparian, deciduous, mixed coniferous habitats. Prefers riparian habitats. North-facing slopes, with plucking perches are critical requirements. Nests usually within 275 ft of water.
Amphispiza belli belli **Bell's Sage Sparrow** State: Species of Special Concern	(Nesting) nests in chaparral dominated by fairly dense chamise. Found in coastal sage scrub, alluvial scrub in southern range. Nest located on the ground beneath a shrub or in a shrub 6-18 inches above ground. Territories about 5 yds apart.
Aquila chrysaetos **Golden Eagle** State: Species of Special Concern	(Nesting and wintering) rolling foothills, mountain areas, sage-juniper flats, deserts. Cliff-walled canyons and large trees in open areas are used for nesting habitat.
Falco peregrinus **Peregrine Falcon** Federal: Delisted State: Endangered FWS: MNBMC	Although not strictly tied to aquatic habitats, peregrine falcons rely upon populations of flocking birds such as shorebirds and ducks during the colder months, therefore favoring shorelines and shallows (Harris 1996, Fix and Bezener 2000). Preferred nesting sites include inaccessible cliffs on rocky outcrops and in river gorges (Fix and Bezener 2000).

Haliaeetus leucocephalus **Bald Eagle** Federal: Threatened State: Endangered	Adult and immature eagles from Alaska and the Pacific Northwest migrate along the coast following the salmon runs (Buehler 2000). They are typically situated within two miles of water bodies that support adequate food supply (Lehman 1979, USFWS 1986). Bald eagle nests are usually located in uneven-aged, multi-storied stands with old-growth components (Anthony et al, 1982).
Nycticorax nycticorax **Black-crowned Night Heron** BLM: Sensitive	Nests are placed individually or, most commonly, in colonies numbering up to several hundred pairs in trees, shrubs, or marsh vegetation; they are occasionally concealed in dense undergrowth. Black-crowned night herons are sometimes abroad during the day, but specialize in hunting at night. At that time they occupy many foraging venues in wetlands, along shores, or otherwise in proximity to water.
Pandion haliaetus **Osprey** State: Species of Special Concern	Ospreys forage over larger bodies of water and roost and nest on exposed treetops, towers, pilings, or similar structures near lakes, reservoirs, rivers, estuaries, and the open sea coast.
Phalacrocorax auritus **Double-crested Cormorant** State: Species of Special Concern	(Rookery site) colonial nester in coastal cliffs, offshore islands, and along lake margins. Usually in tall trees. Nests along coast on sequestered islets, usually on ground with sloping surface, or in tall trees along lake margins.
Progne subis **Purple Martin** State: Species of Special Concern	(Nesting) inhabits woodlands, low elevation coniferous forest. Nests in old woodpecker cavities, or man-made structures, often in tall isolated tree/snag.
Myotis evotis **Long-eared Myotis** BLM: Sensitive	Uncommon in California, this species is found in nearly all brush, forest, and woodland habitats (prefers forested).
Myotis thysanoides **Fringed Myotis** BLM: Sensitive	Pinyon-juniper, valley foothill hardwood, hardwood conifer.
Myotis yumanensis **Yuma Myotis** BLM: Sensitive	Optimal habitats are open forests and woodlands with sources of water over which to feed. Distribution is closely tied to bodies of water. Maternity colonies in caves, mines, buildings or crevices.

Source: This table is excerpted from the Ukiah Field Office Resource Management Plan. (USDI BLM 2006).

11.0 Aquatic Wildlife Habitats and Species

11.1 Upper Watershed

In 1959 and 1960 stream surveys, portions of streams in the upper Scotts Creek Watershed were considered to be good rainbow trout streams. DFG surveys noted the presence of rainbow trout in Benmore Creek, the upper-most two miles of Scotts Creek and the lowest portion of the South Fork of Scotts Creek (DFG 1959 a & b, 1960 b). In 1997, a DFG survey found the lower and middle sections of Willow Creek to be good habitat for native trout (DFG 1997). Also observed were western pond turtle, yellow-legged frog and Pacific tree frog. The DFG also mentioned the presence of roaches in

Benmore Creek and hardheads, squawfish (pikeminnow) and suckers in Scotts Creek in the section below the first two miles of the headwaters to the confluence with the South Fork. Numerous frogs and salamanders were noted throughout the upper portion of Scotts Creek (DFG 1959a and 1959b). A 1997 DFG survey from Willow Creek to the confluence found trout near Willow Creek, and roach, bluegill, chappal, Sacramento sucker and hitch as well[6].

Amphibians are considered to be indicators of aquatic ecosystem health. There has been worldwide recognition of declining amphibian populations, and an estimated one-third of the world's known species are threatened (AmphibiaWeb 2008). Possible reasons for the declines include habitat loss, disease, contamination with pesticides, metals or other toxic compounds, livestock grazing, water diversions and UV radiation.

Although DFG stream surveys mention the presence of salamanders and frogs, there has been no systematic survey of amphibians in the Scotts Creek Watershed. There is an on-going study of Pacific tree frogs in two ponds in south Cow Mountain, immediately to the west of the Scotts Creek Watershed. University of California Berkeley researchers are investigating the prevalence of malformations. In 2007 and 2008 they found malformations in 8-17.5% of the Pacific tree frog populations in these ponds. They found that water chemistry appeared normal, however the frogs had high levels of a trematode parasite known to cause malformations (Kevin Lunde personal communication, Johnson et al. 1999).

11.2 Lower Watershed

There were five native fish species that used Clear Lake tributaries such as Scotts Creek for spawning. Three of these, the Clear Lake hitch, *Lavinia exilicauda chi*, the Clear Lake splittail, *Pogonichthys ciscoides*, and the Sacramento pikeminnow, *Ptychocheilus grandis*, were large minnow species that contributed to "enormous spring migrations up tributary streams" (Cook, S.F. et al. 1966). The hitch still spawn in Scotts Creek and other tributaries of Clear Lake, and their biology and current status is discussed in detail below. The Clear Lake splittail was found only in Clear Lake and its tributaries. Its population underwent drastic reductions in the early 1940s, and it has not been observed since the 1970s. Earlier drying of Clear Lake tributaries due to diversion of water and groundwater pumping may have contributed to the demise of the splittail. Peak splittail spawning occurred two weeks after that

[6] It was not possible to contact the personnel who carried out the survey to determine whether the observation of Clear Lake hitch was accurate. In most years a bridge in Scotts Valley blocks hitch migration at the lower end of the main valley. The DFG survey was carried out on July 15, 1997, long after migrating hitch generally return to Clear Lake. DFG Fisheries Biologist Rick Macedo confirmed that he has observed hitch spending the summer in pools on Kelsey Creek when the fish were trapped by the stream drying downstream (Rick Macedo, personal communication).

of the hitch, and it had a longer requirement for its young to remain in nursery streams than do hitch (Cook, S.F. et al. 1966, Macedo, R. 1994).

The Sacramento pikeminnow was previously called the Sacramento squawfish. Like the Clear Lake splittail, populations of the Sacramento pikeminnow in Clear Lake declined drastically in the early 1940s. The pikeminnow is a fluviatile or river-adapted species, unlike the Clear Lake hitch and splittail which have become adapted to lake conditions.

The Sacramento sucker, *Catostomus occidentalis*, is a native fish with a similar history to the pikeminnow. Although it was not recorded as part of large spring migrations, it was frequently taken by hook and line from Clear Lake prior to the 1930s, and became rare by 1966. Like the pikeminnow, suckers are stream and river adapted.

Tributaries of Clear Lake were spawning streams for steelhead (anadramous Rainbow trout) prior to the 1914 construction of a dam across Clear Lake's outlet on Cache Creek. The Pacific Lamprey, *Lampetra tridentatea*, another anadramous fish, is also listed as having occurred in Clear Lake, but now extinct there.

The 1960 DFG survey of the lower portion of Scotts Creek found unidentified cyprinids and centrarchids due to turbid conditions. These groups would include many of the native and introduced fish species in Clear Lake. This observation is confirmed by more recent observations from DFG biologists. Fish that have been observed in Clear Lake tributaries include bullhead catfish, carp, and largemouth bass (Rick Macedo, personal communication).

11.3 Clear Lake Hitch

Recovery of the Clear Lake hitch, a subspecies found only in Clear Lake and its tributaries has become the focus of a local CRMP group called the Chi Council and local Native American Tribes. The hitch are a large minnow that has been designated a species of special concern in California because of decreasing populations and limited geographic distribution (Moyle et al. 1995). Their spawning runs were once one of the most impressive natural events in the tributary watersheds of Clear Lake:

> "Hitch mass by the thousands and ascend the many streams leading into Clear Lake. The tumultuous splashing in creeks and the appearance of herons, osprey, egrets, and bald eagles in trees overhanging streams signify to the human observer that the hitch are in. Along stream banks, raccoons, mink, otter, and even bears join the birds to feast on hitch as they make their way up swiftly flowing streams" (Macedo, R. 1994).

The hitch was also once a staple food for native peoples.

There is limited documentation of historic hitch populations. Pre-1900s historical records described streams that were packed solid with fish on some years (Allison G.M. and W. R. McIntire 1949, Rideout, W.L. 1899), and a 1960s study of fish in Clear Lake considered the hitch to be abundant (Cook, S.F. et al. 1966). Local residents agree, however, that runs in recent years are much reduced relative to earlier decades, and hitch have disappeared from Schindler and Seigler Canyon Creeks, where they once occurred. Long time watershed residents at a Scotts Creek Watershed History Meeting remembered thousands of hitch in Pool and Hendricks Creeks in the 1950s and 1960s, and hitch so abundant that they filled almost any drainage channel or small stream (SVWC 2008).

Since 2004 a local group, the Chi Council, has been carrying out volunteer monitoring of hitch spawning runs. This group has documented annual variability in hitch runs and even a disappearance of spawning runs in Clover and Middle Creeks in 2006 and 2007, with a return in 2008 (Chi Council 2008). The greatest number of hitch sighted on Scotts or Hendricks Creeks from 2005-2008, was 50 (observed April 14-15, 2006 in Scotts Creek along Highway 20).

It is interesting to compare the change in attitudes toward protecting the hitch. When there was a proposal to build "Lakeport Lake", a reservoir located upstream of Scotts Creek where it enters Scotts Valley, DFG biologists were asked for their opinion on how it would affect hitch runs on Scotts Creek. The response was:

> "It is the writer's feeling that we not worry about preserving the hitch runs of Scotts Creek for the following reasons:
> a. Conflicting data on spawning requirements for hitch makes it difficult to justify flow releases for hitch spawning.
> b. Conflicting data as to the importance of hitch as a forage fish to the Clear Lake bass fishery makes it difficult to justify enhancement for hitch and compensation for hitch in Scotts Creek.
> c. A good bass forage fish, the threadfin shad is available as a fish that could replace the hitch as a forage fish in Clear Lake. As is well known, threadfin shad do not require tributaries to spawn and therefore would be a more desirable forage fish. In other words, let's plant threadfin shad and forget about hitch" (DFG 1962).

Numerous factors are believed to have contributed to the decline in hitch populations. Many fish species introduced to Clear Lake over the past century feed on hitch juveniles, and channel catfish and large-mouth bass feed on adults (Moyle P.B. et al. 1995). Other introduced species such as the Mississippi silversides and threadfin shad compete with hitch for food.

Wetlands along the shores of Clear Lake are important habitat for juvenile hitch and have declined by 79% from their original extent (Week 1982). Spawning habitat has been reduced because streams dry up earlier than in the past, and because of barriers to hitch migration. The greatest barrier to hitch migration on Scotts Creek, is the footing of a private bridge located approximately 13.4 miles upstream of the mouth of Scotts Creek. Prior to construction of this footing, hitch runs were thought to have continued upstream to as high as the confluence with the South Fork of Scotts Creek, an additional 4.8 miles. Another barrier created by a culvert has been identified on a tributary to Hendricks Creek (Plate 7). While it is not evident how hitch enter Cooper Creek, which involves crossing the levee around Tule Lake, they were observed in Cooper Creek in Bachelor Valley in 2009.

Additional smaller barriers to hitch passage are likely to be present, and a survey to identify and prioritize all barriers to hitch migration is an important first step to eliminating these barriers. There are many unknown factors about the hitch, for example their swimming capabilities and requirements for fish passage, the importance of shoreline habitat in juvenile hitch survival, and factors determining the size and success of spawning runs. The Chi Council continues to pursue contacts and funding with government agencies and academic institutions to study the hitch and improve their habitat (Chi Council 2004). Local Tribes began a hitch tagging study in 2009, and they are developing an Adaptive Management Plan that will address migration barriers, high nutrient loads, water use for agriculture and development, and stream flows.

A more detailed description of the hitch life cycle and the reasons for the decline in hitch populations is given in Appendix L.

11.4 Clear Lake Fisheries

Many of the fish found in Clear Lake may also use the lower reaches of tributaries such as Scotts Creek. As of 1995 there were 11 native and 19 introduced fish species in Clear Lake, and 3 native species that are now extinct in Clear Lake (Table 11-1). A thorough description of when species were introduced and changes in fish populations is beyond the scope of this assessment. From the list of species and their status below, it is clear that the populations of many native fish have declined while some introduced species have thrived.

Table 11-1 Past and present fish species known to have occurred in Clear Lake, California.

Common and Scientific Names	**Native (N) or Introduced (I)**	**Status (A,C,R,E)***
Rainbow trout, *Oncorhynchus mykiss*	N	R
Brown trout, *Salmo trutta*	I	R
Pacific Lamprey, *Lampetra tridentata*	N	E
Goldfish, *Carassius auratus*	I	A
Carp, *Cyprinus carpio*	I	A
Clear Lake hitch, *Lavinia exilicauda chi*	N	R-C
Golden shiner, *Notemigonus crysoleucas*	I	R
Sacramento blackfish, *Orthodon microlepidotus*	N	C
Clear Lake splittail, *Pogonichthys ciscoides*	N	E
Sacramento Pikeminnow, *Ptychocheilus grandis*	N	R
California roach, *Hesperoleucas symmetricus*	N	R
Hardhead, *Mylopharodon conocephalus*	N	E
Fathead minnow, *Pimephales promelas*	I	C
Thicktail chub, *Gila crassicauda*	N	E
Sacramento sucker, *Catostornus occidentalis*	N	C
White catfish, *Ictalurus catus*	I	C
Brown bullhead, *Ictalurus nebulosus*	I	C
Channel catfish, *Ictalurus punctatus*	I	C
Mosquitofish, *Gambusia affinis*	I	C
Threadfin shad, *Dorosoma petenense*	I	R**
Inland silverside, *Menidia beryllina*	I	A
Threespine stickleback, *Gasterosteus aculeatus*	N	R
Sacramento perch, *Archoplites interruptus*	N	R
Green sunfish, *Lepomis cyanellus*	I	R
Bluegill, *Lepomis macrochirus*	I	A
Redear sunfish, *Lepomis microlophus*	I	R-C
Pumpkinseed, *Lepomis gibbosus*	I	R
Largemouth bass, *Micropterus salmoides*	I	A
Smallmouth bass, *Micropterus dolomieui*	I	R
Black crappie, *Pomoxis nigromaculatus*	I	R-C
White crappie, *Pomoxis annularis*	I	R-C
Tule Perch, *Hysterocarpus traski*	N	C
Prickly sculpin, *Cottus asper*	N	A

* Status designations are subjective, based on electrofishing observations, and may not represent a definitive survey of the abundance of each fish species. These status designations have not attempted to place the species population in context relative to historical abundance. Electrofishing stations are typically associated with a variety of littoral, or shoreline habitats, are usually observed at night, and most of the stations have been revisited regularly over the past eight years in the spring and fall. A= Abundant, or present in large numbers at all or nearly all stations that correspond to the species preferred habitat; C=Common or present at most stations; R=Rare, or present at a few stations; E=Extinct, or have not observed the species at any stations.
Source: DFG 2000. This table was updated in 1995.
**Threadfin shad populations go through boom and bust cycles, and at times they are abundant.

12.0 Invasive Species

Invasive species are a form of "biological pollution", capable of damaging ecosystems just like other forms of pollution. Invasive species are defined as any non-native species "whose introduction does or is likely to cause economic or environmental harm or harm to human, animal, or plant health" (United States 1999). They include plants, animals, and disease-causing microorganisms such as bacteria and fungi, and they occur in all ecosystems from lakes and streams to forests, grasslands, and agricultural areas. Some traits that are common to many invasive species include rapid growth and reproduction, and the abilities to spread, adapt to a wide range of conditions, and live off a range of food types (Wikipedia 2008). Once established invasive species may be spread both by human activities and natural causes such as animal movement, wind or water movement. In most cases the original introduction of a non-native species occurred due to human activities.

Identification of which species are invasive is complicated by differing human perspectives. While a non-native species may provide benefits to some people, if its negative effects outweigh the beneficial effects, it is considered invasive. An example is water hyacinth which has been popular in aquatic gardens, but when it escaped to natural areas it completely covered lakes and rivers, devastating their ecology. As a practical matter "because invasive species management is difficult and often very expensive, these worst offenders are the most obvious and best targets for policy attention and management" (NISC 2006). Invasive species are also considered to be those not under human control or domestication. Therefore escaped domestic plants and animals can be considered invasive if they meet the definition of invasive species (NISC 2006).

An essential ingredient to control of invasive species is public awareness of the species that are present and how to prevent the introduction of new species. In Lake County an annual tour has been offered to educate the public about invasive terrestrial weeds. Signs and informational pamphlets are widely available to educate the public on preventing the introduction and spread of the aquatic invasive weed hydrilla and zebra and quagga mussels.

12.1 Terrestrial Invasive Species

12.1.1 Plants

Invasive species are a continuing problem leading to:

- Reduction of native plant populations, including endangered species.
- Loss of wildlife habitat and food sources.
- Degraded range and timber lands.

- Increased fuel loads.
- Reduced water resources.

A brief summary of the plants considered to be most noxious in Lake County is given in Table 12-1.

Table 12-1 Invasive terrestrial weeds in Lake County.

Name	Description	Economic or Environmental Harm
Arundo/Giant Reed *Arundo donax*	10-20 ft. tall cane-like stems, perennial.	Found in riparian areas; Excludes other vegetation creating monoculture unsuitable for bird and wildlife habitat.
Brooms, Scotch & French *Cytisus scoparius & C. monspessulanus*	5-10 ft. tall shrubs with yellow flowers in late spring.	Replaces native woody and annual species; Prevents tree seedling growth; Increases fuel load.
Medusa Head *Elymus caput-medusae*	Winter annual grass resembling foxtail, 10-12 in. tall.	Replaces desirable rangeland forage plants; High silica content makes it unpalatable to livestock and wildlife.
Milk thistle *Silybum marianum*	6 ft. tall thistle with 2 ft. long dark green leaves, pink flowers in late spring.	Forms dense, impenetrable thickets; Can be poisonous to livestock.
Perennial Pepperweed/White top *Lepidum latifolim*	2-4 ft. tall stalks, white flowers in early June.	Common in riparian areas, roadsides and fields; Displaces native species and habitat.
Puncture vine/Goats head *Tribulus terrestris*	Annual, forms circular, flat mat, seeds sharp, yellow flowers.	Found in disturbed areas; Seeds that form by late summer puncture bicycle tires, injure feet and hooves.
Tamarisk/ Salt cedar *Tamarisk sp.*	Large, up to 25 ft. tall shrub, pink blooms in late spring.	Grows in stream channels, moist areas; Eliminates native plants through rapid growth and reproduction and accumulation of salt in soil; High water user.
Tree of heaven/Chinese sumac *Ailanthus altissima*	Deciduous tree with large, compound leaves, yellow green flowers become papery seeds.	Extensive, vigorous root system damages roads, sidewalks, buildings; Spreads; Toxin from roots inhibits other plants.
Yellow Starthistle *Centaurea soltitalis*	Annual or biennial weed, up to 3 ft. tall, yellow flowered, spiny seed heads.	Poisonous to horses, mules and donkeys; Poor forage for cattle; Competitive, replaces desirable plants.

Source: Lake County Agricultural Commissioner. 2002. Invasive Weeds of Lake County.

Mapping for arundo and tamarisk has been carried out under a grant received by the West Lake RCD and LCPWD. Starting in 2001, the Lake County Weed Management Area (LCWMA), began a program to monitor and eradicate arundo and inventory tamarisk throughout the county. The program has located 14 arundo sites in the Scotts Creek Watershed (Plate 13). Funding to eradicate arundo is on-going.

The BLM Resource Management Plan calls for treatment (by plowing, mowing or herbicide use) of up to 50 acres of yellow starthistle, medusahead, Italian thistle and Harding grass (USDI BLM 2006). Available information on invasive plants in BLM Cow Mountain lands is incomplete, and an in-depth survey for invasive species is needed (Gregg Mangan, personal communication).

12.1.2 Animals

Often the populations of threatened and endangered animal species are reduced by habitat loss and degradation. The addition of a non-native species that preys on them or competes for food and other resources poses a serious additional threat.

Examples of non-native mammals that belong to the group associated with increased negative consequences and are often referred to as “invasive” species include the roof rat, Norway rat, and feral house cats, all of which prey on native birds and small mammals. Feral pigs cause environmental damage by rooting the soil, which causes erosion and promotes invasive/exotic weed establishment, and readily feeding on native wildlife and vegetation (Figure 12-1). At the same time, feral pigs provide popular hunting activites. The California DFG reported 5,438 were taken in the state in 2005/2006 (Kreith, M. 2007).

Figure 12-1 Soil disturbance caused by wild pigs in the Scotts Creek Watershed. *Photo by Jared Hendricks Jr.*

The European starling was introduced to the United States in 1890 and first appeared in California in the 1960s. Since then it has become widespread and is known to compete with other birds for nest cavities. Wild turkeys, not native to California, were introduced in the 1970s and have successfully established populations throughout the state. A popular game bird, their environmental impacts are unknown at this time, though their voracious appetites are well documented. Brown-headed cowbirds *were* once found only in the Midwest where they followed bison herds. They have expanded their range to most of North America. Cowbirds are brood parasites, laying their eggs in the nests of other birds, and they can seriously affect reproduction of numerous songbird species.

With a $31 billion agriculture industry in California, introduced insect pests pose a significant economic threat. In addition, eradication or control of the pests may require increased pesticide use with the potential for environmental harm. Insect pests newly introduced to California with the potential to damage Lake County crops include two vineyard pests, the glassy-winged sharpshooter[7] and vine mealybug, and the light brown apple moth, which threatens a variety of orchard crops and grapes. Other insect pests that may affect agriculture, landscape, and forest plant species include several fruit fly species, the Japanese beetle, and the Gypsy moth. The Lake County Agriculture Department (LCAD) has trapping programs for these pests (Section 17.9). Thus far the county is free of them with the exception of vine mealybug, which has been found in one vineyard outside the Clear Lake watershed.

12.1.3 Diseases and Parasites

Some diseases and parasites are included in definitions of invasive species (NISC 2006). Although no guidelines were found on what was included, it appears that only recently introduced diseases and parasites with a source or vector in the natural environment are considered. West Nile virus, transmitted by mosquitoes and causing disease in humans and birds, is considered an invasive species. The Lake County Vector Control District monitors for the presence of West Nile virus and controls mosquito populations in the county. Sudden Oak Death, is a disease affecting many oaks in coastal counties (Section 10.1).

12.2 Aquatic Invasive Species

12.2.1 Plants

Many invasive aquatic plants arrived as aquarium (hydrilla and Eurasian watermilfoil) or landscaping plants (water hyacinth, water primrose) (Table 12-2). These plants have the ability to form dense mats, interfering with boating and swimming. When they reach the surface or float on the surface,

[7] The glassy-winged sharpshooter damages vines by vectoring Pierce's disease, a bacteria that plugs xylem vessels and kills vines.

they provide habitat for mosquito larvae in small protected pools of water in their foliage.

Table 12-2 Invasive aquatic plants in Lake County, California.

Name	Description	Economic or Environmental Harm
Hydrilla *Hydrilla verticillata*	Rooted, submerged plant with branching stems, pointed leaves, reaches up to 36 ft.	Forms dense vegetation mats that interfere with recreation and destroy fish and wildlife habitat; Spreads by fragmentation, seeds, tubers.
Eurasion Watermilfoil *Myriophyllum spicatum*	Rooted, submerged plant with feathery leaves., 3-10 ft. tall or more.	Forms very dense mats; Spreads by fragments; Competetive due to early spring growth.
Water hyacinth *Eichornia crassipes*	Free-floating with rounded, leathery leaves, large purple to violet flowers, few inches to 3 ft. tall	Rapid growth and reproduction cause rapid extension of free-floating mats; Seeds eaten and transported by water fowl.
Water primrose *Ludwigia peploides & L. hexapetala*	Bright yellow flowers and willow-like leaves, creeping on shoreline, floating, or upright	Forms dense of mats of vegetation, primarily along margins of lakes and streams; Spread by seeds and plant fragments; Out-competes tules and other emergent aquatic vegetation.

Source: Lake County Agricultural Commissioner. 2002. Invasive Weeds of Lake County.

Of the plants listed in Table 12-2 hydrilla is considered the most serious invasive plant because of its ability to spread rapidly and form dense mats throughout the water column. It is an A rated pest by the California Department of Food and Agriculture (CDFA), requiring eradication. It was discovered, and the eradication program began in Clear Lake in 1994. CDFA crews have eliminated it throughout most of Clear Lake, and they continue to monitor for it by sampling plants on the lake bed. The CDFA Hydrilla Program crews monitor for other invasive and native aquatic submerged plants as part of the program to monitor for hydrilla.

Water primrose is a damaging invasive because of its competition with tules which provide important nesting habitat for grebes. Eurasian watermilfoil is present in Clear Lake, but has not reached damaging populations. A population of water hyacinth was detected in Clear Lake and was removed.

12.2.2 Animals

Numerous fish species have been introduced to Clear Lake (Table 11-1), and these introductions have reduced native fish populations. Some of the introduced fish such as bass, bluegill, crappie, and catfish, prey on juvenile fish, and bass and catfish consume adult fish as well. Other introduced fish such as the silversides and shad are planktivores that compete for food with native fish like the hitch that rely on the same food source. The introduced fish species are not considered invasive because many provide the benefit of improved sport fishing, and because elimination of the introduced species is not possible. Management, for example increasing wetlands important for the survival of juvenile fish, may help to insure the survival of native fish populations.

Bull frogs, *Rana catesbeiana*, are native to the eastern United States, and were introduced to California around 1900. Along with invertebrate prey, adult bull frogs prey on other amphibians and even mice, snakes, birds and young turtles. They damage native amphibian populations both by preying on them and by competing for space (DFG 2005). They are found where year-round water is available.

Non-native freshwater mussels, such as the quagga and zebra mussels and New Zealand mud snail, pose a significant threat to Clear Lake. Both of the mussel species reproduce rapidly, covering hard surfaces, clogging water intake pipes, and covering beaches with their small, sharp shells. They are filter feeders capable of consuming a large proportion of the plankton, microscopic floating plants and animals, present in a water body. Because plankton are the base of the food chain for aquatic ecosystems, this can severely affect the entire ecosystem. Both species are found throughout the eastern United States, and both are now found in several water bodies in California (USGS 2008). To prevent their introduction into Clear Lake water, the Lake County Board of Supervisors adopted an urgency ordinance on March 25, 2008 requiring inspection of all vessels entering Clear Lake (Lake County 2008).

The New Zealand mud snail is found in scattered locations around California including Putah Creek and the Russian River. It prefers moving water and is found in streams, rivers, and lakes. It may have the potential to out-compete native invertebrates that are important food sources for fish, such as mayflies, caddisflies, and chironomids (DFG 2008).

13.0 Fire and Fuel Load Management

With California's dry summers, fire is a natural occurrence, and many plants and animals are adapted to fire. The severity of wildfires depends on the dryness of vegetation and ground cover, weather conditions, such as wind speed and temperature, and the amount of fuel available. The severity and extent of fires determines the damage to wildlife and plant communities as well as the potential erosion, sedimentation and changes in hydrology following a fire. Wildfire damage to people, their communities, and livelihoods depends on where people choose to live and work and how they manage their property and surrounding fire-prone areas. Prescribed or controlled burning and other fuel reduction methods help to avoid the build up of heavy fuel loads and therefore the potential for severe wildfires.

13.1 Fire Cycles

> "Where there is fire, there is a fire cycle. The fire cycle is the number of years, on average, that a fire historically moved through the area. It is also called the fire return interval. Every ecosystem has a fire cycle. Even the coastal areas have fire cycles, though they are very long—perhaps 300 years or more. But in very hot, dry areas, fire cycles might be as short as every 1–7 years" (Nunamaker, C. 2002).

The quote above refers to natural fire cycles in California, which are determined by factors such as vegetation, dry weather conditions, and the frequency of thunderstorms. For the California North Coast a ranking of the length of natural fire cycles, which includes fire ignition by Native Americans, states "In general the most frequent fire occurred in grasslands and oak woodlands, with decreasing fire frequencies in chaparral, mixed evergreen, and montane mixed conifer" (Stuart, J.D. and S.L. Stephens 2006). For the Cow Mountain BLM planning unit, covering much of the upper Scotts Creek Watershed, the natural fire cycle has been estimated to be 20-40 years according to one reference (USDI BLM 2004) and 35-100+ years according to another (USDI BLM 2006).

In many areas of California there is evidence that Native Americans deliberately set fires to manage local ecosystems. This included using fire in grasslands and oak woodlands, (Ortiz, B.R. 2006, Anderson, K. 1993, Stuart, J.D. and S.L. Stephens 2006), and in chaparral ecosystems of California's Central and South Coast (Keeley, J.E. 2002). Writing specifically about the Clear Lake area Simoons (1952) notes that "with an abundant fish and fowl resource there may have been less incentive for burning than in areas where hunting furnished a larger part of the food." However, it is likely that Native Americans contributed to the local fire regime, if only due to accidental fires.

Settlers in the Clear Lake region used fire to thin out brush and encourage grass growth for livestock, to increase deer feed, and to prevent fuel accumulation in coniferous forests (Simoons F.J. 1952). Sheepmen were notorious for setting large fires, and loggers used fire to clear recently logged land, with the potential for fire escape to unlogged forests (Stuart, J.D. and S.L. Stephens 2006). In the Scotts Creek Watershed ranchers and sportsmen regularly set fires prior to the late 1930s (Hendricks 1968).

In the early twentieth century a policy of fire exclusion was adopted by the United States Forest Service (USFS). By the late 1930s strict regulations by the California State Division of Forestry prevented Scotts Creek Watershed ranchers from burning chaparral rangelands. In ecosystems that previously had short fire cycles these policies had unintended consequences. In areas of local shrubland it is likely that fire suppression has led to replacement of grass understory/oak woodlands with chaparral (J. Tunnell, personal communication). The severe Scotts Creek Watershed wildfire in 1981 killed many of the blue oaks in the Scotts Creek Watershed and created fire scars on the remainder of the trees (Jared Hendricks Jr., personal communication).

Plate 14 shows the location of fires in the Scotts Creek Watershed since the early 1900s. The last major wildfire in the watershed was in 1981 when the Cow Mountain fire burned approximately 26,000 acres and reached the outskirts of the City of Lakeport. Beginning in the 1980s the BLM began a program of prescribed burning to reduce fuel loads (discussed in fire management section below).

13.2 Fire and Natural Communities

There are many examples of plants in the Scotts Creek Watershed that are fire-adapted. The importance of fire in chaparral is recognized in most definitions of the plant community. “Chaparral is a shrubland or heathland plant community found primarily in California, USA, that is shaped by a Mediterranean climate (mild, wet winters and hot dry summers) and wildfire” (Wikipedia 2007). Many chaparral plants have seeds that require intense heat to germinate and/or fire-resistant roots that enable them to re-sprout quickly following a fire (CDFFP 2001). Oak trees can withstand burning of much of their foliage. Even when severe fires kill the tops of oak trees, many will sprout from their base the following year (McCreary, D.D. 2004).

Most animals are able to avoid fires of moderate severity. Lizards, snakes, and reptiles survive by going below ground during a fire. Birds can fly from a fire, although their young are vulnerable to fires during the nesting season. Larger mammals such as deer, coyotes, raccoons, and bears must escape by running away, and fast moving fires can be dangerous for them. Following an experimental fire on California’s Central Coast that burned 50% of 500 acres of blue oak-coast live oak woodland, researchers found “no substantial or long-term negative impacts to over 150 species of birds, small mammals, amphibians, and reptiles” (McCreary, D.D. 2004).

13.3 Fire Effects on Erosion and Hydrology

Undisturbed soils in natural ecosystems are usually well covered with a combination of vegetation such as grasses and herbaceous plants, duff (plant residues) and woody debris. With greater fire severity, more of the soil cover is removed, which exposes the mineral layer to raindrop impact and overland flow. Fire can also increase water repellency of soil, which increases surface water runoff. Creation of water repellency is unlikely under prescribed fire conditions when initial soil conditions are usually wetter (Robichaud, P.R. 2000).

At a larger scale, the amount of erosion that occurs and the delivery of sediment to water courses depends on numerous factors:

- The steepness of the area that is burned.
- The severity, extent and spatial variability of the fire.
- The presence of highly disturbed areas such as skid trails for logging.
- The severity of post-fire rainfall.

Even the fire suppression response, for example using bulldozers to create fire lines, contributes to erosion. Although such areas are frequently rehabilitated prior to rainfall, they are still likely to have higher than pre-fire levels of erosion (Robichaud, P.R. 2000, USDAFS 2005).

Following a wildfire both water quality and hydrology are likely to be affected. Increased sediment in streams may smother aquatic invertebrates and cover gravels needed for fish spawning. Drinking water purveyors may experience higher water treatment costs. In January 1997, treatment plants in Lakeport, Nice, and Lucerne were unable to adequately treat water due to high turbidity from the Forks Fire which burned approximately 30% of the Middle Creek watershed in 1996 (USDAFS 1999). Sediment is a major source of phosphorus to surface waters, and the combination of increased nitrogen and phosphorus may lead to eutrophication. Reduced stream cover can cause warmer water temperatures, which can deplete dissolved oxygen (USDAFS 2005).

Water yield, the amount of water coming from a given watershed, often increase following a fire because of reduced plant water use when vegetation is removed. Increased surface runoff following fires will also change the timing of streamflows, causing flood peaks to arrive more rapidly and reach higher levels. The higher streamflows have the potential to move greater amounts of bedload and suspended sediment. Recovery to pre-fire streamflows may take from several years to decades (Robichaud, P.R. 2000).

13.4 Urban-Wildland Interface

Although Scotts Creek does not have any urban areas, it does have many residences in fire prone areas, termed the urban-wildland interface. Fire hazard is very high throughout most of the Scotts Creek Watershed (Plate 15). Firefighters are better able to protect buildings in areas of more concentrated development, such as subdivisions, than buildings that are scattered more widely in the fire hazard zone. This is because they can concentrate resources in these areas, and property owners can set up effective fire breaks in and around these areas.

There are many information sources on fire safety for homeowners in the urban-wildland interface (Appendix A) Clearing a defensible space, free of highly flammable material, around buildings is required by California law.

Other ways to protect structures include using less flammable building materials and creating easy access for firefighters (Anonymous 2007).

13.5 Fire Management

Local fire districts respond to structure fires. The Lakeport Fire District covers Scotts Valley north to the Glen Eden trail. North of this area (Blue Lakes, Highway 20 corridor, Bachelor Valley) is covered by the Northshore Fire Protection District. CAL FIRE is responsible for response to wildland fires on both private and BLM lands.

A large proportion of the chaparral-covered lands in the Scotts Creek Watershed are owned and managed by the BLM (Plate 16), so their fire management plan has a major impact on fire management for the watershed. The BLM Fire Management Plan (FMP) guides wildfire suppression activities, fuels management, fire rehabilitation, and education on fire prevention.

Under the BLM FMP, prescribed burning is done to reduce fuel loads, improve wildlife habitat and manage invasive weeds. While the target for annual prescribed fire and mechanical fuel treatments is up to 1,000 acres in the Cow Mountain unit, in most years less than 400 acres are burned and/or treated (USDI 2006, Jeff Tunnell personal communication). Numerous conditions must be met for prescribed burns to be initiated. Fall burning is preferred, and burns must be carried out after there has been sufficient rainfall (2 or more inches) followed 1-2 weeks of dry weather, followed by wind-free conditions. In addition there must be sufficient manpower available from CAL FIRE, which may not be the case when there are wildfires in southern California or other areas.

Within the FMP there are individual burn plans for smaller units. A large portion of the Cow Mountain Recreation Area was covered by the Pyramid Ridge Unit, but the CAL FIRE vegetation management plan (VMP) for that unit expired in 2009. VMPs are plans in which CAL FIRE, the BLM, and private landowners cooperate and share costs for fire prevention. BLM is currently putting together a plan for a smaller unit covering BLM lands north of the Mendo-Lake (Scotts Creek) Road in the South Cow Mountain Recreation Area. Objectives of the VMP are to improve wildlife habitat and reduce wildfire hazard by creating a mosaic of burned areas. Renewal of a VMP in this area is important to reduce the threat of large scale wildfires, such as the 1981 Cow Mountain Fire, and to improve wildlife habitat.

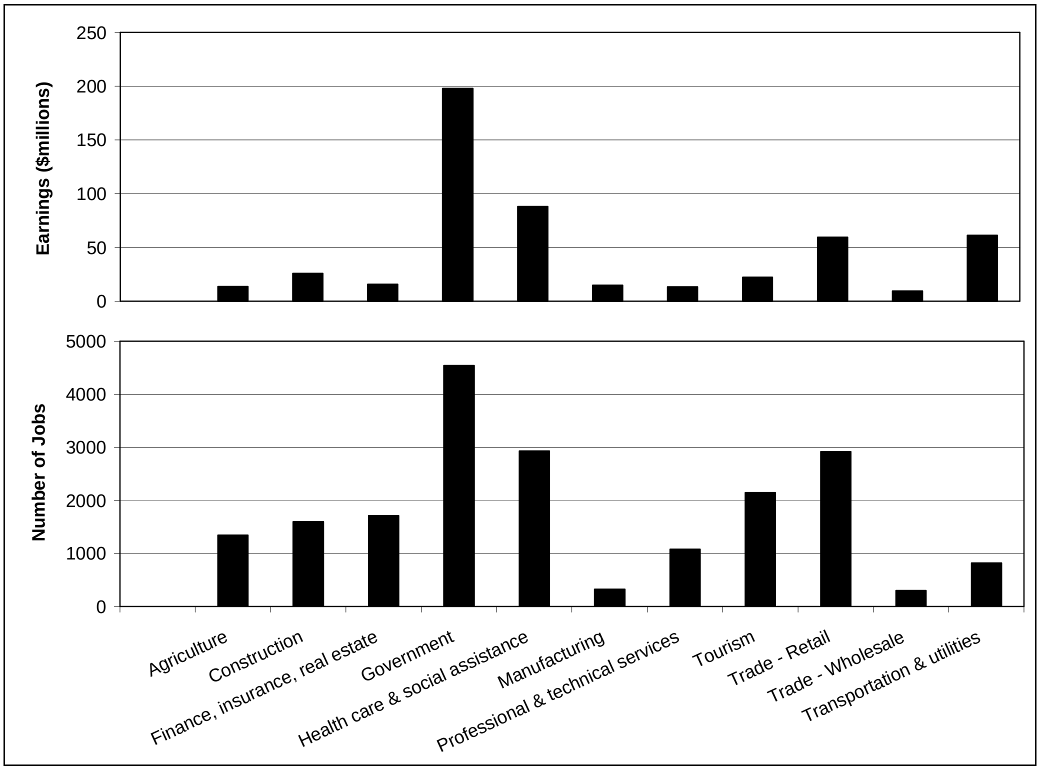
On the eastern side of BLM Cow Mountain lands is a 5 mile long fuel break created in 2001 on a ridgeline above and to the west of Scotts Valley. Along with the 3.5 mile section on BLM land, an additional 1.5 miles was added on private property. A mower/mulcher was used to cut and mulch brush in a 30-100 foot wide fuel break. The fuel break provides an area to stage a wildfire response, but alone it is not wide enough to stop wildfire from spreading. It is intended as an aid to vegetation management on BLM lands that provides a barrier to prevent prescribed burns from escaping. Larger scale prescribed burns on BLM lands to the west of the fuel break have greater potential to protect private lands and residences to the east, including Scotts Valley and Lakeport.

Continued maintenance of the fuel break is necessary to prevent excessive re-growth of vegetation. Private landowners have carried out prescribed burns on the fuel break to keep some parts of it open. BLM is in the process of contracting for maintenance, and possible extension of the current fuel break in 2010 using mechanical mastication (Jeff Tunnell, personal communication; Jared Hendricks Jr., personal communication).

14.0 Social and Economic Setting

There are no towns in the Scotts Creek Watershed, although the City of Lakeport lies to the east of Scotts Valley, and the town of Upper Lake lies to the east of the watershed along Highway 20. Economic activity in the watershed largely consists of agriculture and tourism, and many residents of the watershed work outside the watershed in Lakeport, Ukiah, or other areas. Major agricultural areas in the Scotts Creek Watershed are Scotts Valley, Bachelor Valley, and Tule Lake. Important crops are pears, wine grapes, walnuts, wild rice, and hay, and livestock production is largely limited to cattle. The focus of tourism in the Scotts Creek Watershed is the resorts around Blue Lakes.

There is no information on employment specific to the Scotts Creek Watershed, therefore information for the entire county is discussed here. The largest sources of employment in Lake County for both the number of jobs and earnings are government, health care and social assistance, and retail trade (Figure 14-1). Per capita income in Lake County in 2006 was $28,993 compared to $39,626 for California as a whole (BEA, USDC 2008). Because Lake County's median income is below the state median, local agencies and organizations are able to claim "disadvantaged community" status in many grant applications.



Source: U.S. Department of Commerce, Bureau of Economic Analysis

Figure 14-1 Employment and earnings for the principal industries in Lake County, 2004.

Lake County's population is projected to grow approximately 15% each decade from 58,000 in 2000 to 107,000 in 2050 (State of California, Department of Finance 2007).

15.0 Land Use

15.1 Land Use Categories

Major land use categories in the Scotts Creek Watershed are shown in Plate 16, and the area of each category is given in Table 15-1.

Table 15-1 Land uses and their area in the Scotts Creek Watershed.

Land Use Category	Area (acres)
Heavy Commercial/Industrial	43
Light Commercial	372
High density residential	46
Low density residential	1,658
Agriculture	5,448
Rural lands	23,747
Public Lands	32,332
Resource Conservation	3,136

Heavy Commercial/Industrial - This category includes activities such as manufacturing, natural resource processing, research facilities and "heavy" commercial activities. It includes uses such as large construction/contractor yards, warehouses, mills, automotive and equipment sales and services, and welding and fabrication yards. There are 43 acres designated industrial and service commercial in the Scotts Creek Watershed, and these designations are located on the Highway 20 corridor near the eastern side of the watershed and on Highway 29 near Lakeport (LCCDD 2008).

Light Commercial - This category includes local commercial, community commercial, and resort commercial land use designations. It includes businesses to meet local commercial, retail, and service needs such as general merchandise stores, hardware stores, restaurants, professional offices, and gasoline service stations. It also includes businesses oriented toward tourism, such as resorts and campgrounds (LCCDD 2008).

Residential - High density residential areas have a density of 1-20 dwelling units per acre. In the Scotts Creek Watershed they are found only in the Blue Lakes area. Low density residential areas have less than one residence per acre in a semi-rural setting. Most low density residential development is found on the east side of Bachelor Valley and near the City of Lakeport (LCCDD 2008).

Agriculture - There are over 5,400 acres designated as agriculture in the Scotts Creek Watershed, located primarily in Scotts Valley, Bachelor Valley, Benmore Valley, and Upper Lake Valley. In addition most of Tule Lake, which is designated as resource conservation, is used for wild rice production. Agriculture is zoned with a minimum lot size of 40 acres in order to protect the county's agricultural resources and prevent development that would remove the land from agriculture. Agricultural lands "are actively or potentially engaged in crop production, including horticulture, tree crops, row and field crops, and related activities. Wineries and the processing of local agricultural products such as pears and walnuts are encouraged within this designation" (LCCDD 2008). Agricultural lands are also considered important for groundwater recharge and supporting the natural infrastructure of watersheds.

Rural Lands - Thirty-six percent of the Scotts Creek Watershed is in rural lands. These are privately owned lands, primarily in their natural state. They are areas that are "remote, or characterized by steep topography, fire hazards and limited access" (LCCDD 2008). Typical uses include animal raising, crop production, game preserves, and single family residences, and the minimum lot size is 20-60 acres depending on slope. These lands are important in groundwater recharge and supporting the natural infrastructure of watersheds.

Resource Conservation lands are important for the maintenance of natural resources within the county, including watershed lands that collect precipitation and lands important for groundwater recharge. This land use designation is used primarily for water courses and water bodies in the Scotts Creek Watershed.

Public lands include lands owned by the BLM, University of California, USFS, County of Lake, and City of Lakeport. These lands make up 48% of the Scotts Creek Watershed, and the BLM is the largest landowner. The primary focus of the BLM Cow Mountain unit is for day use recreation. (See recreation section below.)

15.2 Land Use Issues

Many human activities have significant and sometimes detrimental effects on watershed resources and functioning. Activities and their impacts that have been covered in previous sections include:

- Road building, grading, and agriculture leading to soil erosion.
- Stream channelization and modifications to riparian areas and floodplains.
- Invasive species control and eradication.
- Fuel load reduction and fire control.

This section includes a few other activities are covered that were not covered in previous sections.

Pesticide Use - Pesticides are used to improve crop yields, reduce and/or eliminate invasive species and vector- born diseases, and maintain infrastructure such as roads and buildings. Pesticides are of concern for their potential to adversely affect aquatic and terrestrial organisms, including humans.

Agriculture accounts for the vast majority of pesticide use in Lake County that is reported to the state Department of Pesticide Regulation (DPR). Residential and commercial use of pesticides is not reported, but probably is significantly lower. Pesticides used for food crops and some other uses are tested for safety and effectiveness, and strict guidelines are developed for their use both by the United States Environmental Protection Agency and DPR. The local Agricultural Commissioner enforces these regulations.

The two major crops in Lake County, wine grapes and pears, which accounted for 83% of total Lake County agricultural commodity value in 2005, used 96% of the total reported weight of pesticide use in Lake County in 2006 (DPR PUR 2008). However, the potential environmental threat posed by wine grape and pear pesticide use is mitigated by the types of chemicals used.

Sulfur, both elemental and lime sulfur, and petroleum oil account for 83% and 93% of the weights of pesticides used in pears and wine grapes, respectively. Both sulfur and oil are acceptable for organic farming, and both have low toxicity. These materials present a hazard when proper protective gear is not used because direct contact can cause irritation of lung passages, skin, or eyes.

Lake County farmers have also made substantial recent changes to reduce pesticide use. Beginning in the mid-1990s, pear growers worked with University of California Cooperative Extension to switch to a pheromone mating disruption method to control the main pear pest, codling moth. This greatly reduced the use of organophosphate pesticides for codling moth and the need to treat for other pests (Varela and Elkins, In Press). Over 70% of Lake County wine grape growers have participated in workshops and seminars on environmentally friendly wine grape growing funded by their local marketing order, the Lake County Winegrape Commission, and Lake County wine grape growers use less pesticides than growers in other wine grape regions (Lundquist 2006). Some Lake County pear and wine grape growers are switching to organic production "an ecological production management system that promotes and enhances biodiversity, biological cycles and soil biological activity" (Organic Trade Association 2008), and 63% of Lake County walnuts are farmed organically.

Other large reported categories of pesticide use include commercial landscaping and structural pest control. Pesticides are used for public health purposes to control mosquitoes and diseases that they vector such as West Nile Virus, and they are used to control hydrilla, an invasive aquatic weed threatening Clear Lake. Pesticide use reporting and pesticide use training are not required for home owners and business owners/managers. While they may not currently be a significant issue in the Scotts Creek Watershed because of the low density of development, pesticides and other toxic pollutants from storm drains serving residential and commercial areas can be significant in some areas.

Marijuana Growing - Illegal marijuana growing operations in the upper watershed may have substantial localized impacts on watershed health. Lake County has led the state's Campaign Against Marijuana Production, CAMP, in the number of plants seized from 2006-2008. In 2008 500,000 plants were seized in Lake County, mostly from public lands. Marijuana growing operations frequently rely on water diversions from streams and may significantly de-water small streams during summer months (Figure 15-1). There have been observations of ponds built adjacent to streams for fertilizer mixing, which cause both sediment and fertilizer inputs to streams (Figure 15-2). Diesel spills from generators used to power pumps or other equipment have also contaminated waterways (Anderson 2008, Edmison 2007).

Figure 15-1 Water diversion from ephemeral stream at pot garden cleaned up in the upper Scotts Creek Watershed, 2008. *Photo by Gary Sharpe, BLM.*

Figure 15-2 Pit built for fertilizer mixing and/or water diversion near Eight Mile Valley, 2008.
Photo by Gary Sharpe, BLM.

Clean up costs for theses sites are considerable with "fertilizers, pesticides, rodent poison, propane tanks, food, human waste, tarps, and plastic tubing… widely scattered in remote regions" (Anderson 2008) (Figure 15-3). Although many illegal marijuana growing operations are located on public lands, public agencies receive only fraction of the funds needed to clean them up. Gary Sharpe, Associate Field Manager at the Ukiah BLM office, estimates that "We could easily go through $1 million a year for the next five years…And that's if (the pot cultivation) stopped" (quoted in Anderson 2008).

Figure 15-3 Trash at pot garden clean up site in Scotts Creek headwaters, 2008. *Photo courtesy Gary Sharpe, BLM.*

In 2008 the BLM received about $20,000 to clean up two sites in the Scotts Creek Watershed. One near Eight Mile Valley had 500 plants, and another in the headwaters of Scotts Creek contained 3-5,000 plants. In 2009, BLM sought additional funding to clean up marijuana gardens throughout Ukiah BLM properties (Gary Sharpe, personal communication).

Illegal dumping occurs along quiet roadsides and in local streams and creeks. It can cause significant pollution and be very costly to clean up. The Scotts Creek Watershed Council conducts an annual creek clean up in the area of the confluence of Scotts Creek and its South Fork. Programs to prevent illegal dumping are covered in Section 18.1.5.

16.0 Recreation and Open Space

Land use in the Scotts Creek Watershed consists largely of agricultural lands or undeveloped lands in a relatively natural condition. The SCWC identified the protection of open space as an important watershed goal, which concurs with Lake County general plan goals and policies for open space, conservation, and recreation. Specific policies with relevance to protection of open space include:

> "The County shall strive to protect natural resource areas, fish and wildlife habitat areas, scenic areas, open space areas, and parks from encroachment or destruction by incompatible development and invasive species."

> "The County shall preserve natural open space resources through the concentration of development in existing communities, use of cluster development techniques, maintaining large lot sizes in agricultural areas, avoiding conversion of lands currently used for agricultural production, and limiting development in areas constrained by natural hazards" (LCCDD 2008).

County recreation goals and policies recognize the need for sufficient parks, trails, recreational facilities, and lake access to serve county residents and visitors.

The Lakeport Area Plan lists the following objectives related to open space preservation:

- Promote practices that ensure the protection of the Lakeport Planning Area's diverse vegetation and wildlife.
- Promote a mixed land use pattern that provides for the orderly and efficient development of the Planning Area coordinated with the City of Lakeport to take the development pressure away from the Scotts Valley area.
- Protect and preserve the area's archaeological and historical resources for the long-term benefit of residents, tourists, scientists, and future generations.
- Protect important scenic resources in the Lakeport Planning Area.
- Promote the programs that conserve and protect the unique natural resources of the Lakeport Planning Area.
- Promote land use patterns within the Lakeport Planning Area that maintain and preserve the area's natural resources.
- Protect Scotts Valley for agricultural enterprises (LCCDD 2000).

Almost half of the Scotts Creek Watershed is owned and managed by the BLM. The northern section of BLM land, North Cow Mountain, is managed for non-motorized activities including hiking, hunting, camping, horseback riding, and mountain biking. It has one developed campground, a designated rifle range and 17 miles of foot trails. A large area of this section is managed under the BLM classification of Backcountry, which is an essentially roadless area, providing wildland recreation while protecting watersheds and wildlife (USDI BLM 2006). Much of this area, including Cow Mountain and upper Scotts Creek and its tributaries, are in a pristine, near wilderness condition (Jared Hendricks Jr., personal communication). The BLM Backcountry area is divided from north to south by a private landholding of approximately 877 acres. This property is currently up for sale, and the BLM is investigating the possibility of acquiring the land (Richard Burns, personal communication). Other portions of North Cow Mountain are classified Middlecountry, which is a natural landscape except for primitive roads, trails, and basic sanitation facilities (USDI BLM 2006). The portion of North Cow Mountain with the access road and rifle range is classified as Frontcountry, which functions as a staging area to provide access to Middle and Backcountry.

The southern portion of BLM land, South Cow Mountain, is managed primarily for OHV use. It has 93 miles of vehicle trails, two developed campgrounds, and two OHV staging areas on 23,000 acres. Lands are designated primarily as Frontcountry to the north and west and Middlecountry to the south and east (USDI BLM 2006). Activities in this section include an annual motorcycle rally, during which South Cow Mountain is closed to the general public. There have been increasing requests for similar events, and the BLM Resource Management Plan (BLM RMP) allows for up to four such events annually. Improved access is needed for large profile vehicles and trails entering South Cow Mountain. Roads entering this area are narrow, steep, and windy, making large vehicle access difficult. The BLM is currently in the process of putting together a new recreation plan along with an associated business management plan for the entire Cow Mountain unit, which will be completed by 2010.

In 1997, as part of the Scotts Creek Watershed Project, all of the South Cow Mountain OHV trails were surveyed (LCFCWCD 1997). Trails with the highest erosion potential were those that were present prior to BLM land management. These trails were poorly designed, constructed, and managed. Also of a high priority were streams and trails within 300 feet of a stream or those that cut through soils with a high K (erodibility) factor. The report recommended reclaiming highly erosive or unused trails by re-vegetation or other methods, or if necessary, upgrading the roads with drainage structures and maintenance. It is not clear to what extent these recommendations were followed. The current BLM RMP proposes continuing to develop a loop trail system and developing up to 40 miles of re-routed trail to protect erodible soils and sensitive resources and expand recreational opportunities in South Cow Mountain. In North Cow Mountain, the BLM RMP proposes building up to 40 miles of mechanized and non-motorized use trails (USDI BLM 2006). BLM has identified the need for repairs on four miles of the Mendo-Lake Rd (Scotts Creek Rd.) in order to control erosion and provide for visitor safety.

A survey of the current condition of all roads and trails on BLM lands is not available. In recent years the BLM has closed roads and trails to prevent erosion and built bridges and hardened water crossings to prevent damage to streams. Three bridges were built over Benmore , Willow and Panther Creeks in South Cow Mountain from 2000-2001. Road status in North and South Cow Mountain is shown in Table 16-1.

Table 16-1 Road Status in the Cow Mountain Recreation Area.

Road Status	North Cow Mountain (miles of roads)	South Cow Mountain (miles of roads)
Open to remain open	26.67	93.12
Open to be closed	0	7.27
Closed to remain closed	21.36	12.17

Source: (USDI BLM 2006)

The BLM position for recreation planner for South Cow Mountain has been vacant for the last three years. The planner position is important to insure that OHV users do not create unauthorized trails, to monitor trail conditions for safety and damage potentially causing erosion, and to seek funding for trail and water crossing improvements. Staff observations indicate that recreational OHV use on South Cow Mountain has increased significantly since the Congressional Recreation Area designation in 2006 and the closing of a large OHV area in the Hollister area in 2007.

Other problems from recreational use of the Cow Mountain Recreation Area include vandalism, night time rowdiness, and irresponsible shooters who damage signs and trees and leave behind large numbers of shotgun shells. The number of law enforcement positions in the Ukiah BLM office has decreased in recent years from 4 to 2 (Doug Pratto, personal communication).

The confluence of Scotts Creek with the South Fork of Scotts Creek has long been a popular area for OHV use, and is the point where Scotts Creek Rd., the main east-west road over Cow Mountain, enters BLM land. In this area several problems have been identified that occur due to limited oversight. These are: shooting litter from target shooting, illegal dumping, tire burning, and drug dealing. OHV riding in abandoned walnut orchards and the creek beds has led to accelerated erosion as described in Section 7.6. There is currently no staging area on the Lake County side of Cow Mountain. Development of a staging and overnight camping area in the confluence area would provide for improved management and oversight.

17.0 Current Watershed Management

17.1 Soil Conservation

The Lake County Grading Ordinance (LCCDD 2006) establishes standards for grading and erosion control plans based on project size and soil erosion hazard. The Lake County Community Development Department (LCCDD) is responsible for enforcing compliance with the ordinance. The Natural Resource Conservation Service (NRCS) is a branch of the USDA with an office in Lakeport. They provide technical assistance on conservation of soil, water, and other natural resources and have programs for cost-sharing on selected conservation measures.

17.2 Water Quality Protection

Lake County Department of Environmental Health administers regulatory programs that include components designed to protect drinking water quality. These include permits, inspection and enforcement for water well installation, small public drinking water systems (having 5 to 14 connections and serving fewer than 25 people daily over 60 days of the year), on-site septic sewer systems, underground storage tanks, hazardous material disposal, and solid waste facilities.

Regulation of large public drinking water systems is by the California Department of Public Health. The California Drinking Water Source Assessment and Protection Program requires large public drinking water systems to complete a drinking water source assessment that includes an inventory of possible contaminating activities and a vulnerability ranking to potential contamination (CDHS 1999).

The Lake County Clean Water Program is charged with controlling pollution from urban and other storm drains. To comply with federal mandates for stormwater pollution prevention, the LCCDD manages this program in cooperation with the cities of Lakeport and Clearlake. The CVRWQCB oversees compliance with this program. LCCDD also ensures compliance with the newly updated Lake County grading ordinance.

The Sacramento Valley Water Quality Coalition monitors stream water quality and promotes agricultural best management practices locally and throughout the Sacramento River watershed to comply with CVRWQCB requirements to reduce non-point source pollution from irrigated agriculture.

Clear Lake is impaired for both nutrients and mercury under Section 303(d) of the Federal Clean Water Act. This required the CVRWQCB to work with the county and other entities to develop pollution control plans, “total maximum daily loads” (TMDLs) for these contaminants. A monitoring and implementation plan for both the Clear Lake Mercury and Nutrient TMDLs was submitted in October 2008 by the Clear Lake TMDL Stakeholder Committee (CLTSC), comprised of government agencies involved with land and resource management in the area, such as the County of Lake, Bureau of Land Management and USFS; the Bradley Mining Company (owner of the Sulphur Bank Mine) in the case of the mercury TMDL; and the Lake County Irrigated Lands Watershed group in the case of the nutrient TMDL. The CLTSC goals are:

A. Control: Combine resources to achieve required mercury and nutrient load reductions and to eliminate the impairment of the beneficial uses of Clear Lake.

B. Information Exchange: Share information regarding best management practices, monitoring data, and methods.

C. Cooperation:
   1. Develop and implement a Plan to reduce the input of mercury and reduce the mercury concentrations in the lake sediments.
   2. Develop and implement a Plan to collect the information needed to determine what factors are important in controlling nuisance algae blooms and to recommend what control strategy should be implemented (CLTSC 2008).

An update of the Lake County General Plan and an accompanying Environmental Impact Report were approved in September 2008 (LCCDD 2008). The General Plan recognizes water quality issues and regulatory requirements with the goal of protecting surface and groundwater quality. Implementation includes a review process of proposed developments to evaluate potential contaminants and verify compliance with regulatory requirements such as the National Pollutant Discharge Elimination System (NPDES), Stormwater, and TMDL programs. The county will monitor and work with industries that may discharge pollutants to surface waters, ensure compliance with current regulations, and reduce wastewater discharges. Through the Grading and Stormwater Ordinances, the county will "ensure that erosion control measures are utilized during construction and post construction." The county will "attempt to inventory watersheds that drain into Clear Lake and identify those which carry high levels of pollutants and those that have high sediment yield" in order to prioritize them for restoration and management (LCCDD 2008).

17.3 Streambed, Lake, and Wetland Alterations

Activities in streams, lakes, and wetlands, such as debris removal, restoration projects, or stabilization structures, may require permits and environmental review from a variety of agencies. A first step is often to contact the DFG which requires notification for any activity that will:

- "Substantially divert or obstruct the natural flow of any river, stream or lake;
- Substantially change or use any material from the bed, channel, or bank of, any river, stream, or lake; or
- Deposit or dispose of debris, waste, or other material containing crumbled,flaked, or ground pavement where it may pass into any river, stream, or lake.

The notification requirement applies to any work undertaken in or near a river, stream, or lake that flows at least intermittently through a bed or channel. This includes ephemeral streams, desert washes, and watercourses with a subsurface flow. It may

> also apply to work undertaken within the flood plain of a body of water" (DFG 2008c).

If DFG finds that "the activity may substantially adversely affect fish and wildlife resources" then a Lake or Streambed Alteration Agreement is necessary as required in Section 1602 of the Fish and Game Code.

Placement of structures or dredged or fill materials in waters of the United States[8] requires a Section 404 permit from the USACE and Section 401 Water Quality Certification from the RWQCB. In addition, the state of California requires a permit for discharge into "isolated" waterbodies (EPA 2007, SWRCB 2008).

17.4 Water Infrastructure and Supply

The Lake County Groundwater Management Plan (CDM and DWR 2006c) provides guidance on managing groundwater resources. Objectives of the Lake County Groundwater Management Plan include maintenance of a sustainable high quality water supply for agricultural, environmental, and urban uses, facilitation of projects to replenish groundwater, and improved understanding of groundwater resources.

The Lake County General Plan states several goals with regard to ensuring water availability (LCCDD 2008). Goal WR-3 is "to provide a sustainable, affordable, long-term supply of water resources to meet existing and future domestic, agricultural, industrial, environmental, and recreational needs within the county, so as to maintain sustainability between new development and available water supplies". Implementation measures include designating and managing groundwater recharge areas, managing groundwater resources to ensure sustained yields, working with public agency water providers and local stakeholders to develop groundwater management partnerships, identifying critical water resource areas, and participation in local, state, and regional water resource planning efforts.

17.5 Flood Management

Within the WRD, the LCWPD is responsible for flood management and updates the floodplain management plan. Lake County participates in the NFIP which was established in 1968 to provide flood insurance to property owners in return for community floodplain management regulations to reduce future flood damage potential. Lake County has a qualifying floodplain management plan, and therefore Lake County residents can purchase flood insurance under the NFIP (Lake County 2000, FEMA 2002).

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[8] Waters of the United States includes "All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including…tributaries of all waters mentioned above" (SRWP 2008).

Flood hazard is addressed under the Draft Lake County General Plan Goal HS-6 “to minimize the possibility of the loss of life, injury, or damage to property as a result of flood hazards.” In 1% flood chance zones, General Plan policies allow passive recreational activities such as hiking and horseback riding, prohibit the development of critical facilities, and require other developments to minimize flood risk to structures and infrastructure (LCCDD 2008).

Maintaining clear stream channels helps to maintain flow capacity and reduce flood potential. The Lake County Sheriff’s Office of Emergency Services website urges property owners to “Remove debris, such as trash, loose branches, and vegetation growing in the stream channel” (LCS 2008). At the same time, stream channel alterations may require approval by agencies such as the DFG, USACE, and LCCDD (Section 17.3).

A property tax assessment on property owners in Scotts Valley and the Tule Lake area funds Lake County Flood Control Zone 4. Zone 4 was formed in 1958 to fund maintenance for facilities that had been planned on Scotts Creek. Although the facilities were not built, the funds (approximately $8,000/year) are instead used for brush and debris clearing to ensure conveyance capacity in Scotts Creek.

17.6 Wildlife and Habitat Protection

The United States Fish and Wildlife Service (USFWS) administers the Endangered Species Act to protect species and the ecosystems on which they depend. They carry out scientific studies and list species as “threatened” or “endangered”. Once species are listed as endangered, trafficking in the species is prohibited, and critical habitat for the species is protected. The USFWS also has a Division of Migratory Bird Management to conserve migratory birds and their habitats.

The California DFG is the lead agency for fisheries and wildlife management in the state. A description of the agency’s role from their website reads:

> “The Department of Fish and Game maintains native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection and maintenance in a sufficient amount and quality to ensure the survival of all species and natural communities. The department is also responsible for the diversified use of fish and wildlife including recreational, commercial, scientific and educational uses.”

The California Fish & Game Commission adopts fishing and hunting regulations and guidelines for determining whether species have California endangered or threatened status. With respect to non-game species, the DFG manages species of special concern to achieve conservation and recovery before they require California Endangered Species Act listing.

In addition to the potential increase in wetlands under the Middle Creek Project (Section 7.7.1) the DFG recently completed a Clear Lake Wildlife Area (WLA) Conceptual Area Protection Plan (CAPP) that would include the Middle Creek Project, current DFG and Land Trust lands to the south of Rodman Slough, additional land to the south of the Middle Creek Project, and a large portion of Tule Lake, to total approximately 3,225 acres. The Clear Lake WLA would include riparian, wetland, open water and oak woodland habitats. However, once restored, over half of this area would be wetland habitat. The purpose of land acquisition for the CAPP is “the conservation, protection, and restoration of significant wetland and upland habitats and their associated species in once of the few remaining natural areas on Clear Lake” (DFG 2008). This project could provide valuable habitat for a variety of sensitive species including the Northwestern pond turtle, foothill yellow-legged frog, California red-legged frog, tri-colored blackbird, double-crested cormorant, osprey, and bald eagle. The area is an important stopover for songbirds and supports cover for numerous waterfowl and water birds.

The Lake County General Plan goal with respect to wildlife is “to preserve and protect environmentally sensitive significant habitats, enhance biodiversity, and promote healthy ecosystems throughout the county” (LCCDD 2008).

17.7 Fisheries and Aquatic Habitat Protection

As stated above, the California DFG enforces fishing regulations. They also enforce environmental laws with regard to streambed alterations, and potential pollution of waterways due to spills and other illegal discharges.

The DFG 2000 Clear Lake Fishery Management Plan has the objectives “to maintain and enhance 1) fishery resources and the habitats upon which they depend, and 2) provide and where possible, improve fishing opportunities.” The DFG issues permits for bass fishing tournaments and commercial fishing on Clear Lake and enforces compliance with these permits. DFG also regulates sport fishing through the issuance of licenses and enforcement of fishing regulations (DFG 2008b).

A local CRMP group, the Chi Council, is dedicated to watershed and lake management to improve populations of the Clear Lake hitch. Members include representatives of conservation groups, local Tribes, local, state, and federal resource agencies, and concerned citizens. The council organizes volunteer monitoring of spawning runs, encourages scientific research on the hitch, gathers information about the hitch and their uses by native peoples, and sponsors habitat restoration. Local Tribes have programs to monitor hitch spawning runs and stream conditions, and they are preparing an adaptive management plan for hitch.

17.8 Integrated Regional Water Management Plan

The IRWMP is an important planning effort related to numerous aspects of watershed management, including both surface and groundwater supplies. The proposed planning area for the IRWMP will encompass the Clear Lake Watershed and is comprised of the Cache and Putah Creek Watersheds as well as most of the remaining area of Yolo County. The tentative name for the region is the Westside Region. Participating governments/agencies are; Lake, Napa, Yolo, and Colusa Counties and the Solano Water Agency.

The IRWMP will promote a regional and integrated approach to water management and will foster coordination, collaboration, and communication among agencies and organizations responsible for water-related issues. The plan will cover providing water supply reliability, water recycling, water conservation, water quality improvement, stormwater capture and management, flood management, recreation and access, wetlands enhancement and creation, and environmental and habitat protection and improvement. The IRWMP is intended to provide a comprehensive approach to addressing water supplies as a component of the California Water Plan.

Stakeholder meetings for the IRWMP involving Lake County residents, agencies, and organizations began in May 2007. The meetings have gathered input on Lake County priorities, goals, and objectives for the IRWMP. Currently meetings are being held among the cooperating agencies. Lake County is in the process of finalizing goals and objectives (by the end of 2009) to be included in the IRWMP. By the first quarter of 2010, the Lake County contribution for a planning grant application will be completed. The goal for completion of the IRWMP is the end of 2012.

17.9 Prevention, Eradication, and Control of Invasive Species

The US Fish and Wildlife Service has numerous mandates for prevention and control of invasive species. Under the Lacey Act, it regulates the "importation and transport of species, including offspring and eggs, determined to be injurious to the health and welfare of humans, the interests of agriculture, horticulture, or forestry, and the welfare and survival of wildlife resources of the U.S. Wild mammals, wild birds, fish, mollusks, crustaceans, amphibians, and reptiles are the only organisms that can be added to the injurious wildlife list (USFWS 2008)." The National Invasive Species Council is a council of 13 federal departments that deal with invasive species. It was created in 1999 by Executive Order 13112 "to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause" (USDA 2008).

In California, CDFA is charged with prevention of importation of pests and diseases and control of pests within the state. CDFA works in cooperation with the state DFG and the USDA. CDFA focuses on prevention of invasive plants, insects, and diseases of plants and livestock. DFG focuses on invasive animals including the quagga and zebra mussels. CDFA's exclusion branch includes inspection stations on major highways entering the state and enforcement of quarantines and inspection of packages at parcel carrier terminals within the state. CDFA also provides oversight of nurseries in California (CDFA 2008b). Once finalized, a new amendment to Section 3060.3, Title 3 of the California Code of Regulations will make it illegal for plants classified as noxious weeds to be sold as nursery stock.

CDFA has a program to eradicate hydrilla in Clear Lake and other water bodies in the state. The Clear Lake program, headquartered in Lakeport, has crews that survey the lake and apply herbicides to control hydrilla from April through mid-October.

Many CDFA activities are carried out by county Agricultural Commissioner offices. In Lake County, the Agriculture Department has trapping programs for Japanese beetle, Mediterranean, Mexican, melon and oriental fruit flies, the glassy-winged sharpshooter, vine mealybug, light brown apple moth, and gypsy moth. They have programs to eradicate skeleton weed and to prevent the spread of leafy spurge. They also carry out control of scotch thistle and purple star thistle, depending on the availability of funding. The local Agriculture Department also carries out inspections of packages to local carriers and plant shipments to local nurseries (Steve Hajik, personal communication).

The Lake County Weed Management Area, formed in 2001, is a group that cooperates and coordinates activities and expertise to prevent and control weed problems in Lake County. It is made up of the Lake County Agricultural Commissioner's office, the LCPWD, the East and West Lake RCDs, and the local office of the NRCS, with many other governmental agency, tribal, environmental, and industry groups as partners. Its activities are "focused upon the exclusion, detection, suppression, and eradication of noxious and invasive non-native weeds" (LCWMA 2008).

17.10.1 Fire Hazard Management

Local fire districts respond to structure fires. The Lakeport Fire District covers Scotts Valley north to the Glen Eden trail. North of this area (Blue Lakes, Highway 20 corridor, Bachelor Valley) is covered by the Northshore Fire Protection District. CAL FIRE is responsible for response to wildland fires in the Scotts Creek Watershed. CAL FIRE also implements the BLM Fire Management Plan (See Section 13.5).

A Community Wildfire Protection Plan (CWPP) for the entire county was completed in August 2009 (ForEverGreen Forestry 2009). Local, state, and federal fire protection organizations and other interested parties were involved in developing and reviewing the plan. The plan includes chapters on wildfire behavior, fire ecology, Lake County community features, fire protection organizations, risk assessment, and an action plan. The action plan includes sections on advancing defensible space, reducing fuels and structural ignitability, enhancing fire protection, evacuation planning, and fire safe education.

Lake County CWPP fuel reduction priorities in the Scotts Creek Watershed are expansion of the Cow Mountain Fuel Break and implementing a control burn mosaic in the Upper Scotts Creek Watershed. Both of these projects are considered to have a medium to high overall risk and are prioritized to the 6-10 year timeframe (ForEverGreen Forestry 2009).

In January 2009, Lake County provided short term funding for a Fire Safe Coordinator whose duties are to implement the CWPP and assist local communities in becoming Firewise Communities. By joining together in Firewise Communities neighbors can create a much more effective defensible space around their community. The Firewise Community website also offers excellent education for homeowners (Appendix A).

The Lake County General Plan includes goal HS-7 “to minimize the possibility of the loss of life, injury, or damage to property as a result of urban and wildland fire hazards”. Policies to reach this goal include support of fuel reduction programs, requiring wildland fire management plans for projects adjoining areas that may have high fuel loads, fuel break requirements, and specific development guidelines for lands designated as high and extreme wildfire hazards (LCCDD 2008).

The state of California requires anyone owning, leasing, or otherwise responsible for buildings in wildfire hazard areas to maintain a defensible space around the building. (See Appendix A for resources on defensible space.) CAL FIRE inspects new buildings for compliance with defensible space requirements, and they inspect other buildings when they receive complaints and when time permits (Jim Wright, personal communication).

Landowners wishing to carry out prescribed burns should contact the Lake County Air Quality Management District and CAL FIRE. CAL FIRE can provide technical advice on prescribed burning, and in some instances, when a large area of brushland is involved, CAL FIRE can cost share and provide expertise for prescribed burning.

17.11 Prevention of Illegal Dumping

Lake County combats illegal dumping in several ways. The Lake County Public Services Department (LCPSD) has contracted with two private franchise haulers to provide low cost curbside trash pick-up and recycling. The county also sponsors a free mobile household hazardous material program that is available to residents about once a month to dispose of paint, chemicals, small propane tanks, fluorescent lights, and unusable over-the-counter or prescription drugs.

LCPSD, and LCCED, have a prevention program that encourages residents to use low cost or free disposal and amnesty programs. They educate the public about low-cost/no-cost options for waste disposal through such means as brochures, flyers, a recycling website, newspaper articles, and radio announcements. Enforcement is another approach to prevention. The penalty for illegal dumping (a misdemeanor) is a fine of up to $100 and up to 30 days in jail, or both. Complaints can be reported to LCCED, (707) 263-2309 or to their 24 hour hotline, (707) 263-2308.

Illegal waste clean-up on private property is enforced by LCCED. They also apply for grant funding to clean up illegal dumpsites. For example, they received $35,000 to clean up 17 illegal dumpsites in the county in 2007-2008. When clean-ups involve a health and sanitation issue, the Lake County Environmental Health Division (LCEHD) is involved. LCEHD has funding for clean-up of drug lab chemicals. They have grant funding to ensure that local businesses properly dispose of tires, and this funding includes some money for clean-up of illegally dumped tires.

LCCED, LCEHD, and the Lake County Sheriff's Department investigate reports of illegal dumping. Enforcement is difficult, due to a lack of state guidance on what constitutes sufficient evidence to prove that illegal waste disposal has occurred. Therefore, the Sheriff's Office gets involved when there is prosecutable evidence, such as an eyewitness to the illegal dumping. The DFG enforces state law that prohibits dumping within 150 feet of a water body. The state number to report illegal dumping is (888) DFG-CALTIP. This number is to report both poachers and polluters, and if the reported information leads to an arrest, the reporter is eligible for a reward.

17.12 Land Use Planning

The Lake County General Plan is a comprehensive and long range general plan for the county's development as required by state law. The first land use goal of the Lake County general Plan is to encourage economic and social growth in the county while maintaining quality of life (LCCDD 2008). In part this is to be done by clearly differentiating "between areas within Lake County appropriate for higher intensity urban services and land uses (i.e., high density residential, high density commercial, and industrial) from areas where rural or resource use should be emphasized".

The Lake County Zoning Ordinance establishes specific districts (for example agricultural, rural residential and resort commercial districts) and the standards for land use and construction in those districts. The Community Development Department prepares updates to the County General Plan and to area plans (for example the Lakeport Area Plan). They are responsible for enforcing compliance with the zoning ordinance.

The Planning Commission is an unpaid board of five members, each appointed by the supervisor in their district for a two year term. Their duties are to hold public hearings on proposed zoning, to hear and decide permit applications and applications for variances, to consider maps of proposed subdivisions, and to investigate and make recommendations to the Board of Supervisors with regard to public projects and acquisitions.

17.13 Cultural Resource Management

Potential cultural resources are identified when projects require initial inspection under California law (California Environmental Quality Act, CEQA, sec. 15064.5, 15065 a, 21083.2, 21084.1). The historical or archeological resource comes under the protection of CEQA if it is significant or unique enough to be included in the California Register of Historic Resources including that it:

> (1) is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage.
> (2) is associated with the lives of persons important in our past.
> (3) embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values.
> (4) has yielded, or may be likely to yield, information important in prehistory or history. (CEQA sec. 15064.5)

The first phase of inspection is a background record search and inspection of the site by a qualified archeologist. In some cases a small test excavation is necessary to determine the significance of the cultural resource.

When a unique archeological resource is found, CEQA requires the agency involved to first consider alternatives that preserve the resource in place and in an undisturbed state. Additional regulations apply if the resource cannot be left in place (CEQA sec 21083.2). When the inspection finds the existence or probable existence of Native American remains within the project, the permitting agency must work with the appropriate Native Americans as identified by the Native American Heritage Commission. Accidental discovery of human remains requires determination by the county coroner as to whether they are Native American and contact of the Native American Heritage Commission if they are. Agreements are then made for “treating or disposing of, with appropriate dignity, the human remains and any associated grave goods” (CEQA section 15064.5).

Impairment to historical resources can be mitigated to a non-significant level by following federal guidelines for preservation and restoration of historic properties or by other measures identified by the permitting agency (CEQA sec 15064.5).

17.14 Watershed Education

In many cases the regulatory and management agencies mentioned above are excellent sources of information to watershed users. In addition, some government agencies have the primary mission of technical assistance and education. The NRCS, with an office in Lakeport, provides technical and financial resources to landowners in areas such as soil conservation, wildlife habitat improvement, range and forest land improvement, and sustainable agriculture. The University of California Cooperative Extension office in Lakeport also provides education and technical resources in these areas.

18.0 Findings and Recommendations

18.1 Current Watershed Issues

Prior to compiling this watershed assessment, the SCWC held several meetings to identify issues of concern in the watershed. This process was done to insure that the assessment includes information on topics considered vital by watershed users. In this chapter assessment findings in relation to each issue of concern are briefly reviewed.

18.1.1 Protecting Water Quality

Sediment is the most widely recognized pollutant to watershed surface waters with the potential to damage stream aquatic habitats and Clear Lake water quality. It is also the source of mercury and nutrients, the two contaminants under regulatory requirements for clean up (TMDLs) for Clear Lake. Sediment studies to date have measured the total sediment load for the gaged area of the Scotts Creek Watershed. Areas currently identified where significant streambank erosion occurs include Eight Mile Valley and the Scotts Creek confluence. Streambank erosion may be significant in the section of Scotts Creek from below the confluence to the mouth, but channel conditions have not been surveyed since 1985. Potential erosion caused by unpaved roads and OHV trails and activity were evaluated in the 1997 Scotts Creek Watershed project, but no follow up to this evaluation has been made.

Illegal marijuana growing in the upper watershed has an unknown influence on stream water quality. This occurs both directly by contribution of fertilizer, pesticides and other contaminants, and indirectly by reducing water flows, which leads to higher water temperatures and lower dissolved oxygen.

There has been limited local monitoring for pesticides and aquatic toxicity by the SVWQC under the irrigated lands conditional waiver, 2-3 samples per year beginning in 2005. These samples have shown relatively few problems in McGaugh Slough in Big Valley and Middle Creek. This type of monitoring is quite expensive and therefore would be difficult to carry out outside of a group effort such as the SVWQC.

The “stream team” bioassessment project provided training for local watershed residents and began to collect information on stream conditions. Continuing this program by identification of representative sites in the upper and lower watershed and annual monitoring would provide a valuable record of aquatic ecosystem health and opportunity for involvement of local residents.

In the Scotts Valley aquifer, only one exceedance of a primary drinking water standard and three exceedances of agricultural water quality standards were found from available DWR water quality data. However, the number of samples, was quite limited, and property owners are advised to test their own wells.

18.1.2 Ensuring water availability

Groundwater supply studies in the Scotts Creek Watershed have been limited to the 1970 study of the Scotts Valley aquifer (Wahler & Associates 1970). A recent application for grant funding to update this study was not approved by the Board of Supervisors. Although members of the Scotts Valley Watershed Council supported the application, they were not represented at the Board of Supervisors meeting when a single opponent to the application convinced the Board not to pursue the application.

Groundwater availability will continue to be a significant issue in Scotts Valley. At stakeholder meetings, concern was expressed that residential development in the Scotts Valley area could deplete groundwater resources. Recent reductions in pear acreage have probably reduced groundwater use, however maintaining groundwater availability is important for preserving future potential agricultural, environmental and other uses in the area.

18.1.3 Reducing Wildfire Threat

Natural conditions in the Scotts Creek Watershed insure that wildfire will always be a threat. The BLM has a program of prescribed burning and vegetation management to reduce wildland fire and the chance that it will spread to urban areas. Continued clearing and maintenance of the fuel break to the west of Scotts Valley and prescribed burning on adjacent lands are key to reducing the chance that wildfire will reach private lands and threaten structures in much of the Scotts Creek Watershed and the City of Lakeport.

Efforts by private landowners to implement prescribed burning also have the potential to reduce wildfire threat. Property owners, renters, and managers are required by law to maintain a defensible space around buildings and residences. Compliance with this mandate will not only reduce the chance that fire reaches structures, it will also increase the safety of fire fighters and the likelihood that they will protect the structures.

The Lake County Fire Safe Council provides the opportunity for watershed residents to work on fire hazard mitigation at the community level, and the Fire Safe Coordinator provides assistance for creating Firewise Communities. The recently approved Lake County Community Wildfire Protection Plan prioritizes fuel reduction and fire safety projects and is a foundation for pursuing grant funds to implement wildfire protection projects.

18.1.4 Flood Management and Debris Jams

Frequent flooding occurs along Scotts Creek beginning in Scotts Valley and continuing to its mouth. In most cases floodplain development is limited to agriculture, and flooding causes little permanent damage. Flooding does cause restricted access to several areas in Scotts Valley, and residents in these areas need to prepare for being stranded by flood conditions. Numerous residences and other structures are subject to flooding at Laurel Dell Lake. Construction of Lakeport Lake would provide significant flood protection for Scotts Valley; however cost benefit analyses of this project have not shown it to be feasible. Continuing the approach of avoiding floodplain development is the most reasonable approach to flood management in the watershed. Lake County continues to pursue the Middle Creek Flood Control and Ecosystem Restoration project downstream of Scotts Creek. If this project is implemented, flood levels in the lowest portion of Scotts Creek would be reduced.

Property owners often need to remove debris jams to prevent flooding. Straight, clear channels, can more rapidly move water through an area, however woody debris and meandering channels help to provide diverse riparian and aquatic habitat. When possible, land use practices that allow natural stream processes to occur should be encouraged. When debris jam removal is necessary, it may be necessary to contact government agencies for permits (Section 17.3).

18.1.5 Reducing illegal dumping

The SCWC has carried out annual creek clean-ups since its inception. LCPSD and LCCED have a program to prevent illegal dumping. They work with the county Sheriff's Department and the DFG to catch violators, and the DFG enforces state laws prohibiting illegal dumping. Public Services continues to work closely with the SCWC's cleanup efforts by providing fee waivers for trash and recyclables collected during annual cleanups. Use of surveillance equipment at illegal dumpsites has the potential to increase arrests and prosecutions for illegal dumping.

18.1.6 Protecting Open Space

County policies, as outlined in the 2008 General Plan, encourage maintaining lands for open space, wildlife habitat, and agricultural uses.

Much of the land area of the upper Scotts Creek Watershed is in a relatively natural and undeveloped condition, and much of this land is under federal ownership as BLM lands. Watershed resident support for BLM acquisition of lands within or adjacent to the Cow Mountain Recreation Area can help to protect additional lands.

Large valleys in the lower watershed are still primarily agricultural. When local watershed users identified protection of open space as an important watershed issue, their concerns were focused on the lower watershed, especially near the City of Lakeport, where development pressure is greater.

The major opportunities for watershed users to influence open space protection are through involvement in the environmental review process for development projects, and participation in development of county land use policies, such as the recently adopted General Plan, or area plan updates.

18.1.7 Improving Wildlife Habitat

In the upper watershed, the BLM and private landowners identified the importance of prescribed burning to increase wildlife habitat diversity, improve forage, and increase spring and streamflows for deer and other wildlife. Improvement of springs to support wildlife, particularly in dry years, has been identified as an important project by local landowners.

Riparian areas are important habitat for both aquatic and terrestrial animal species. BLM studies indicate that riparian areas are in "proper functioning condition" on their lands. This description is very general, and a more thorough inventory of riparian and stream conditions would be a valuable resource management tool. The ARMP listed poor and fair conditions for fish habitat in lower Scotts Creek, and the stream team bioassessment rated Scotts Creek as poor. With the exception of the bioassessment in one location, channel and aquatic habitat conditions have not been assessed since the 1987 survey for the ARMP.

18.2 Information and Data Gaps

This watershed assessment identified the following needs for more information/data to adequately understand current watershed conditions:

- Update survey of lower Scotts Creek stream channel conditions.
- Survey of stream channel conditions on BLM lands.
- Survey of trail and road conditions in the upper watershed, including those on private and BLM lands.
- Survey of lower Scotts Creek Watershed for fish passage barriers.
- Improved study of Scotts Valley aquifer conditions (low priority since groundwater demand currently low).

- Survey to determine prevalence of water diversions for illegal marijuana cultivation.

18.3 Recommendations

Actions and projects for watershed management and restoration that were identified through this assessment process include the following:

- Monitor channel and riparian conditions using photo, greenline, and other methods.
- Continue bioassessment monitoring of creek health.
- Sediment source survey focusing on stream channels, roads, and trails.
- Prioritize and implement projects to facilitate fish passage in lower watershed. Decker Bridge has been identified as the highest priority in Scotts Creek.
- Maintain and expand the fire break to the west of Scotts Valley.
- Support prescribed burning program for fire safety and improved wildlife habitat.
- Survey for invasive plants on BLM lands.
- Continue programs to monitor and eradicate invasive plants.
- Based on continuing drought conditions, target prescribed burning to improve streamflows.
- Support prevention of marijuana cultivation and clean up where it has occurred.
- Support continued operation of stream gage by DWR.
- Support further study and restoration of Eight Mile Valley hydrologic function.
- Support BLM acquisition of private land holdings in and adjacent to the Cow Mountain Recreation Area.
- Support filling the Recreation Planner position for the BLM Cow Mountain Recreation Area.
- Repair four miles of the Mendo-Lake Road necessary to control erosion and provide for visitor safety.
- Develop a staging and overnight camping area on the Lake County side of South Cow Mountain.
- Improve overall access to the Cow Mountain Recreation Area.

19.0 Glossary

Term	Definition	Source
303(d) List	Refers to section 303(d) of the Clean Water Act that requires each state to periodically submit to the United States Environmental Protection Agency (USEPA) a list of impaired waters. Impaired waters are those that are not meeting the State's water quality standards. Once the impaired waters are identified and placed on the list, section 303(d) requires that the State establish total maximum daily loads that will meet water quality standards for each listed water body.	SWGP
Acre-ft	A unit of volume commonly used in the United States in reference to large-scale water resources. It is a volume equivalent to the area of one acre (43,560 square feet) covered to a depth of one foot.	W
Alluvial material, alluvium	Soil or sediments deposited by a river or other running water.	W
Anadramous fish	Fish who live mostly in the ocean and breed in freshwater.	w
Aquifer	An underground layer of porous, water-bearing rock, gravel, or sand.	MDC
Aquifer, confined vs. unconfined	**Unconfined** aquifers are covered by permeable geologic formations. They receive recharge water directly from the surface, from precipitation or from a body of surface water (e.g., a river, stream, or lake) which is in hydraulic connection with them. **Confined** aquifers have an impermeable layer at their upper boundary and are typically found below unconfined aquifers. Confined aquifers can be under pressure causing artesian wells, where water rises in the well, sometimes to the land surface.	W
Average Annual flow	The rate at which water flows through a channel, determined by averaging daily measurements of the flow during one entire year.	
Beneficial uses	Refers to the uses that streams, lakes, rivers, and other water bodies, have to humans and other life. Beneficial uses are outlined in a Water Quality Control Plan, also called a Basin Plan. Each body of water in the State has a set of beneficial uses it supports. Different beneficial uses require different water quality control(s). Therefore, each beneficial use has a set of water quality objectives designed to protect that beneficial use. Beneficial uses may include: domestic (homes, human consumption, etc.), irrigation (crops, lawns), power (hydroelectric), municipal (water supply of a city or town), mining (hydraulic conveyance, drilling), industrial (commerce, trade, industry), fish and wildlife preservation, aquaculture (raising fish, etc. for commercial purposes), recreational (boating, swimming), stockwatering (for commercial livestock), water quality, frost protection (misting or spraying crops to prevent frost damage), heat control (water crops to prevent heat damage), groundwater recharge, agriculture, etc.	SWGP
Benthic	Bottom-dwelling; describes organisms which reside in or on any underwater substrate.	MDC
Benthic macroinvertebrate	Bottom-dwelling (benthic) animals without backbones (invertebrate) that are visible with the naked eye (macro). They include crayfish, mollusks, aquatic worms, and the immature forms of aquatic insects, for example stonefly and mayfly nymphs.	MDC
Channelization	The mechanical alteration of a stream which includes straightening or dredging of the existing channel, or creating a new channel to which the stream is diverted.	MDC
Confluence	The location at which two streams intersect and begin to flow as one larger stream.	CWMP
Cubic feet per second (cfs)	A measure of the amount of water (cubic feet) traveling past a known point for a given amount of time (one second).	MDC
Dissolved oxygen	The concentration of oxygen dissolved in water. Dissolved oxygen is a measure of the biological activity of water masses.	MDC
Diversion	A temporal removal of surface flow from the channel	CA SSHRM
Downcutting	When a stream channel deepens over time.	CWMP
Endangered	In danger of becoming extinct.	MDC
Eutrophic	Having waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae. Decay of this plant life often leads to low dissolved oxygen content. Lakes can be naturally eutrophic or can become eutrophic due to human activities that increase water nutrient levels.	MDC
Eutrophication	The process of increasing nutrient and decreasing oxygen supply within a water body.	CWMP
Fault	In geology, a fault or fault line is a planar fracture in rock in which the rock on one side of the fracture has moved with respect to the rock on the other side. Large faults within the Earth's crust are the result of differential or shear motion and active fault zones are the causal locations of most earthquakes. Earthquakes are caused by energy release during rapid slippage along a fault.	W
Flood	Any flow that exceeds the bankfull capacity of a stream or channel and flows out on the floodplain.	CA SSHRM

Flood Attenuation	To reduce the severity of floods, generally by water storage in wetlands or spread in natural floodplains.	CWMP
Flood Peak	The highest amount of flow that occurs during a given flood event.	CWMP
Floodplain	The flat area adjoining a river channel constructed by the river in the presence of a given climate, and overflowed at times of high river flow.	CWMP
Gaging Station	A selected section of a stream channel equipped with a gage, recorder, or other facilities for measuring stream discharge.	CWMP
Geomorphology	The scientific study of landforms and the processes that shape them.	W
GIS	The combination of hardware and software used to store and analyze features located on the earth's surface. (Geographic Information System)	CWMP
Groundwater	Water that is located beneath the ground surface in soil pore spaces and in the fractures of lithologic formations.	CWMP
Headwaters	The small streams and upland areas that are the source of larger streams and rivers. The most distant point in the drainage basin from the river or stream mouth.	CWMP, W
Hydrology	The study of the movement, distribution and quality of water throughout the earth (and atmosphere).	W
Impaired water body	Surface waters identified by the Regional Water Quality Control Boards as impaired because water quality objectives are not being achieved or where the designated beneficial uses are not fully protected after application of technology-based controls. A list of impaired water bodies is compiled by the State Water Resources Control Board pursuant to section 303(d) of the Clean Water Act (CWA).	SWGP
Incised	Deep, well defined channel with narrow width to depth ration, and limited or no lateral movement. Often newly formed, and as a result of rapid down-cutting in the substrate	MDC
Infiltration (water)	Entry of water into soil or other material at the earth's surface.	CWMP
Invasive species	Plant or animal species from another geographic region that once introduced out-compete native plants or animals and take over a habitat area.	CWMP
Land use	Typically a group of similar on-the-ground human uses described as a single category.	CWMP
Large woody debris (LWD)	Logs, stumps, or root wads in the stream channel, or nearby. These function to create pools and cover for fish, and to drop and sort stream gravels.	CWMP
Meandering	When a stream channel has a winding or sinuous path.	CWMP
Metamorphic rock	Metamorphic rock is one of the three main rock types. (The others being sedimentary and igneous.) Itis the result of the transformation of an existing rock type by heat and pressure (temperatures greater than 150 to 200 °C and pressures of 1500 bars[1]) causing profound physical and/or chemical change. The existing rock may be sedimentary rock, igneous rock or another older metamorphic rock.	W
National Pollutant Discharge Elimination System (NPDES) Permit Program	Controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Since its introduction in 1972, the NPDES Permit Program has been responsible for significant improvements to our Nation's and State's water quality.	SWGP
Non-native species	Plant or animal species introduced to an area from another geographic region.	CWMP
Non-point Source (NPS) Pollution	Water pollution that does not originate from a discrete point, such as a sewage treatment plant outlet. NPS pollution is a by-product of land use practices, such as those associated with farming, timber harvesting, construction management, marina and boating activities, road construction and maintenance, and mining. Primary pollutants include sediment, fertilizers, pesticides and other pollutants that are picked up by water traveling over and through the land and are delivered to surface and ground water via precipitation, runoff, and leaching. From a regulatory perspective, pollutant discharges that are regulated under the National Pollutant Discharge Elimination System Permit (NPDES) are considered to be point sources. By definition, all other discharges are considered NPS pollution.	SWGP
Peak flow	The maximum instantaneous rate of flow during a storm or other period of time.	CWMP
Percolation	The act of surface water infiltrating into and through the ground.	CWMP
Planktivore	A general term to describe an organism adapted to feeding primarily on plankton (drifting organisms in water).	W
Plate (tectonic)	Large sections of the Earth's lithosphere (outer-most, rocky layer). There are currently 8 major (for example the North American and Pacific Plates) and many minor plates.	W
Precipitation	The liquid equivalent (inches) of rainfall, snow, sleet, or hail collected by storage gages.	CWMP
Prescribed burning	Also know as controlled or hazard reduction burning or prescribed fire. Usually conducted during the cooler months to reduce fire fuel buildup and decrease the liklihood of serious, hotter fires.	W

Recurrence Interval (return interval)	Determined from historical records. The average length of time between two events (rain, flooding) of the same size or larger. Recurrence intervals are associated with a probability. (For example, a 100-year flood would have a 1% probability of happening in any given year.)	CWMP
Riparian Area	Interface between land and a stream.	W
Riparian Vegetation	Vegetation growing on or near the banks of a stream or other body of water in soils that are wet during some portion of the growing season.	CWMP
Sedimentary rock	Sedimentary rock is one of the three main rock types (the others being igneous and metamorphic rock). Sedimentary rock is formed by deposition and consolidation of mineral and organic material and from precipitation of minerals from solution. The processes that form sedimentary rock occur at the surface of the Earth and within bodies of water.	W
Sedimentation	The deposition or accumulation of sediment.	CWMP
Sediment	Fragments of rock, soil, and organic material transported by and deposited into streambeds by wind, water, or gravity.	CWMP
Stakeholder	A person, group, organization, or system who affects or can be affected by an action.	W
Stormwater	The surface water runoff resulting from precipitation falling within a watershed.	CWMP
Stream degradation	When a stream, or section of stream, is removing more material than it is depositing. The level of the streambed is dropping, and usually the banks are eroding.	
Stream gage	A stream gauge, or stream gage, refers to a site along a stream where measurements of volumetric discharge (flow) are made.	
Stream gradient	The change of a stream in vertical elevation per unit of horizontal distance.	MDC
Streamflow	The active flow of water within a stream, river, or creek. The volume of water passing a given point per unit of time.	CWMP
Subduction	In geology, subduction is the process that takes place at convergent boundaries by which one tectonic plate moves under another tectonic plate, sinking into the Earth's mantle, as the plates converge.	W
Substrate	The mineral and/or organic material forming the bottom of a waterway or waterbody.	MDC
Surface runoff	Water that runs across the top of the land without infiltrating into the soil.	CWMP
Surface water	Water that is flowing across or contained on the surface of the earth, such as in rivers, streams, creeks, lakes, and reservoirs.	CWMP
Sustainable	Resources must only be used at a rate at which they can be replenished naturally.	SWGP
Threatened species	A species likely to become endangered within the foreseeable future if certain conditions continue to deteriorate.	MDC
Tributary	A stream feeding, joining, or flowing into a larger stream or into a lake.	
Total Maximum Daily Load (TMDL)	A TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that load among the various sources of that pollutant. TMDLs are required for water bodies on the 303(d) list.	
Ultramafic (rock)	Igneous and metamorphic rocks with low silicon and high iron and magnesium contents. Often only specially adapted plants can grow on soils formed from ultramafic rocks.	W
Upland	Describing high or hilly country.	
Watershed	The total land area that water runs over or under when draining to a stream, river, pond, lake, or other designated point.	MDC
Weir	A low dam placed in a river or stream to raise its level, divert its flow, or gage the flow of water.	CWMP

	Sources of Definitions
CA SSHRM	CA Department of Fish and Game Salmonid Stream Habitat Restoration Manual <http://www.dfg.ca.gov/fish/REsources/HabitatManual.asp>
CWMP	Carlsbad Watershed Management Program <http://www.carlsbadwatershednetwork.org/cwmp.php> (Accessed 03.10.09).
MDC	Missouri Department of Conservation, MDC.online watershed glossary. http://mdc.mo.gov/fish/watershed/glossary.htm (Accessed 03.10.09)
SWGP	Proposition 84 Storm Water Grant Program, Draft Final RFP
W	Wikipedia - Free online Encyclopedia

20.0 Acronyms

ARMP	Aggregate Resource Management Plan
BLM	United States Bureau of Land Management
CAL FIRE	California Department of Forestry and Fire Protection
CAPP	Conceptual Area Protection Plan
CDFA	California Department of Food and Agriculture
CEQA	California Environmental Quality Act
CLTSC	Clear Lake TMDL Stakeholder Committee
CNDDB	California Natural Diversity Database
CRMP	Coordinated Resource Management Planning
CVRWQCB	Central Valley Regional Water Quality Control Board
CWHR	California Wildlife Habitat Relationships
CWPP	California Wildfire Protection Program
DFG	(California) Department of Fish and Game
DPR	California Department of Pesticide Regulation
DWR	Department of Water Resources
FEMA	Federal Emergency Management Assistance
FMP	Fire Management Plan
IRWMP	Integrated Regional Water Management Plan
LCCDD	Lake County Community Development Department
LCCED	Code Enforcement Division of the LCCDD
LCEHD	Lake County Environmental Health Division
LCPSD	Lake County Public Services Department
LCPWD	Lake County Public Works Department
LCWIA	Lake County Water Inventory and Analysis
LCWPD	Lake County Watershed Protection District
Middle Creek Project	Middle Creek Flood Damage Reduction and Ecosystem Restoration Project
NFIP	National Flood Insurance Program
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service (formerly SCS)
OHV	Off-Highway Vehicle
RCD	Resource Conservation District
SCWC	Scotts Creek Watershed Council
SVWQC	Sacramento Valley Water Quality Coalition
TMDL	Total Maximum Daily Load
USACE	United States Army Corps of Engineers
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VMP	Vegetation Management Plan

WLA	Wildlife Area
WRD	Water Resources Division of the LCPWD

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